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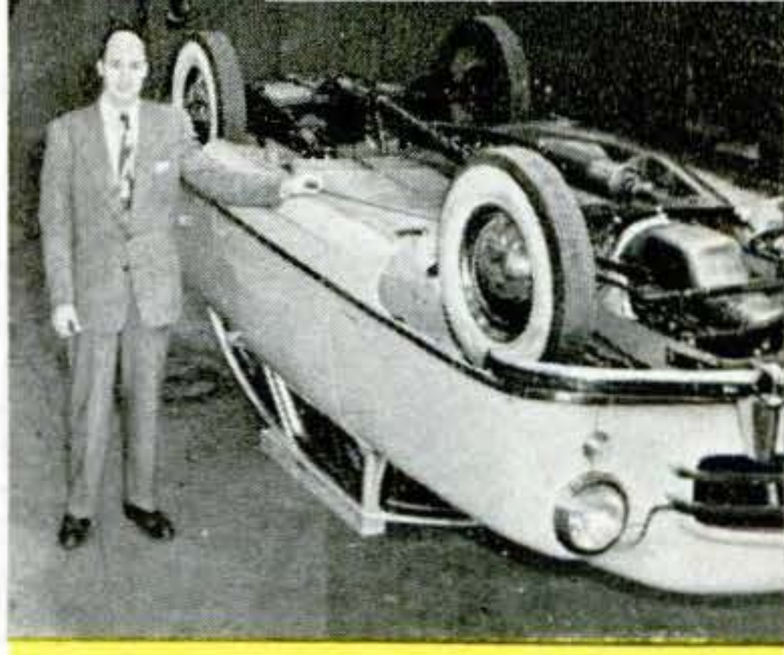
May 1950 Monthly 25¢



New Junior Nash—18 Photos

"I Saw This Jet-Liner Fly 500 M.P.H."

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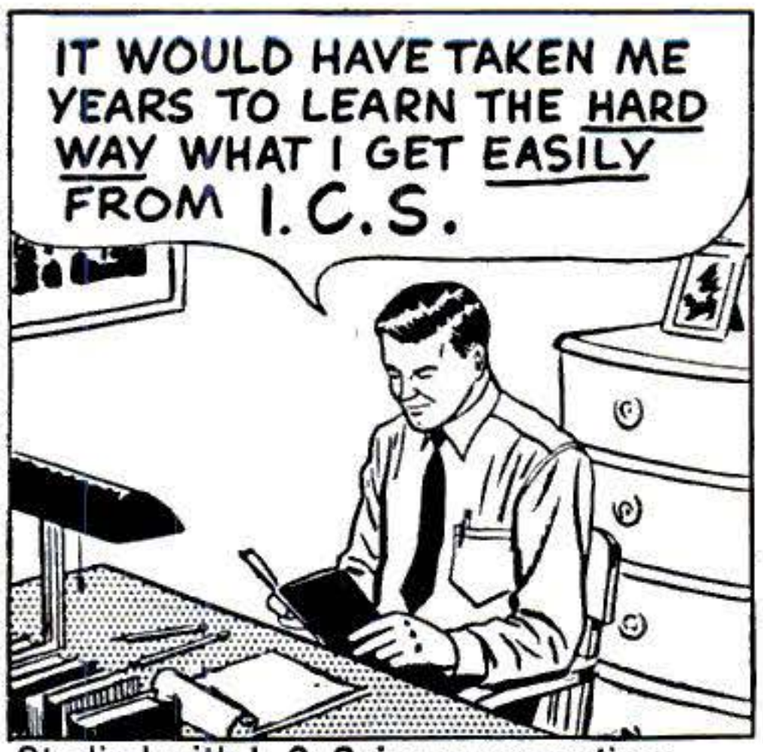
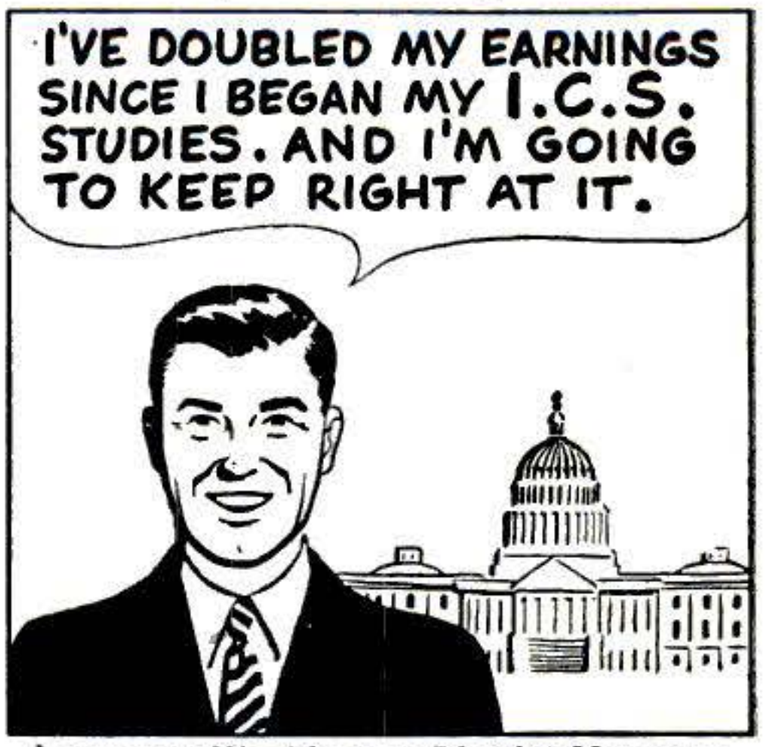
Back home, I was hired by National . . .



Studied with I. C. S. in my spare time . . .

I. C. S. sent reports to my employer . . .



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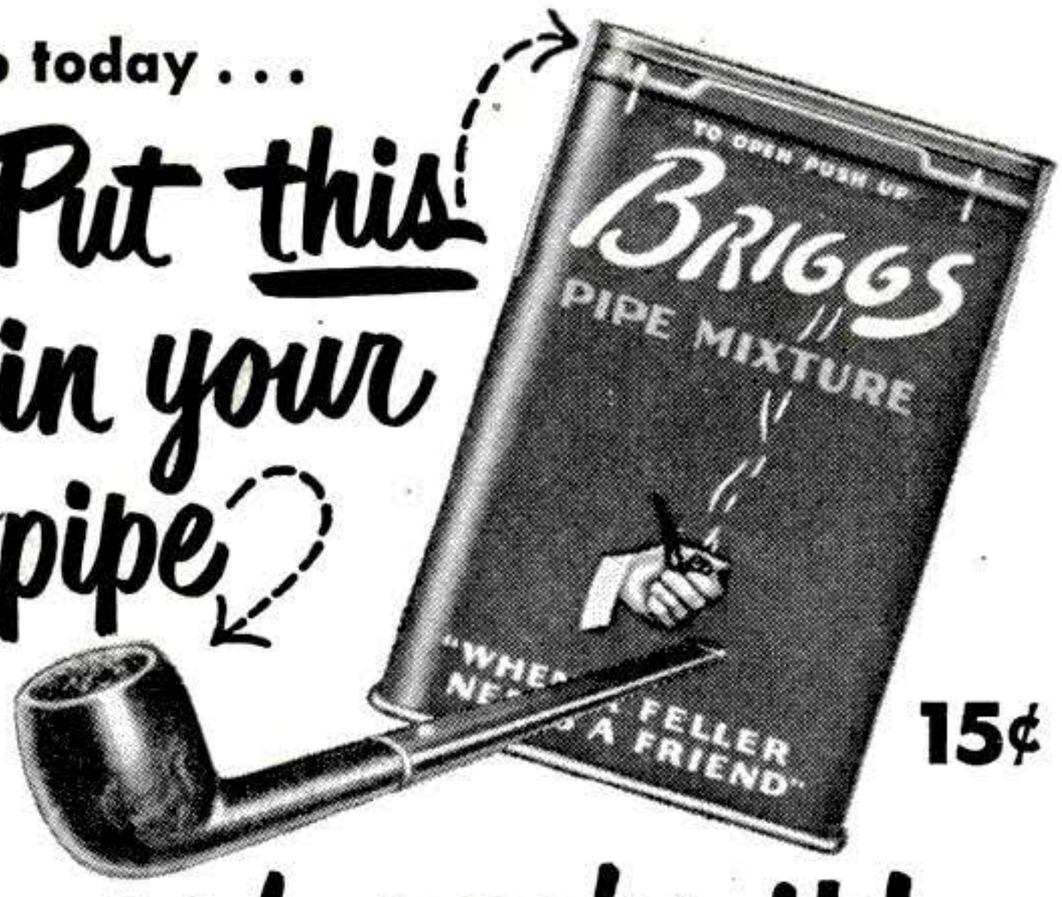

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How to "Expand" Your Attic

IF THE top floor of your home is what real-estate agents glibly call an "expansion" attic—an ill-lighted garret with just enough headroom for stunted midgets—the story on page 202 is for you. A licensed architect describes the step-by-step procedure by which you can build a flat-roofed dormer, giving you a brand-new, useful room. And you don't have to be a practising carpenter to tackle the job, either.

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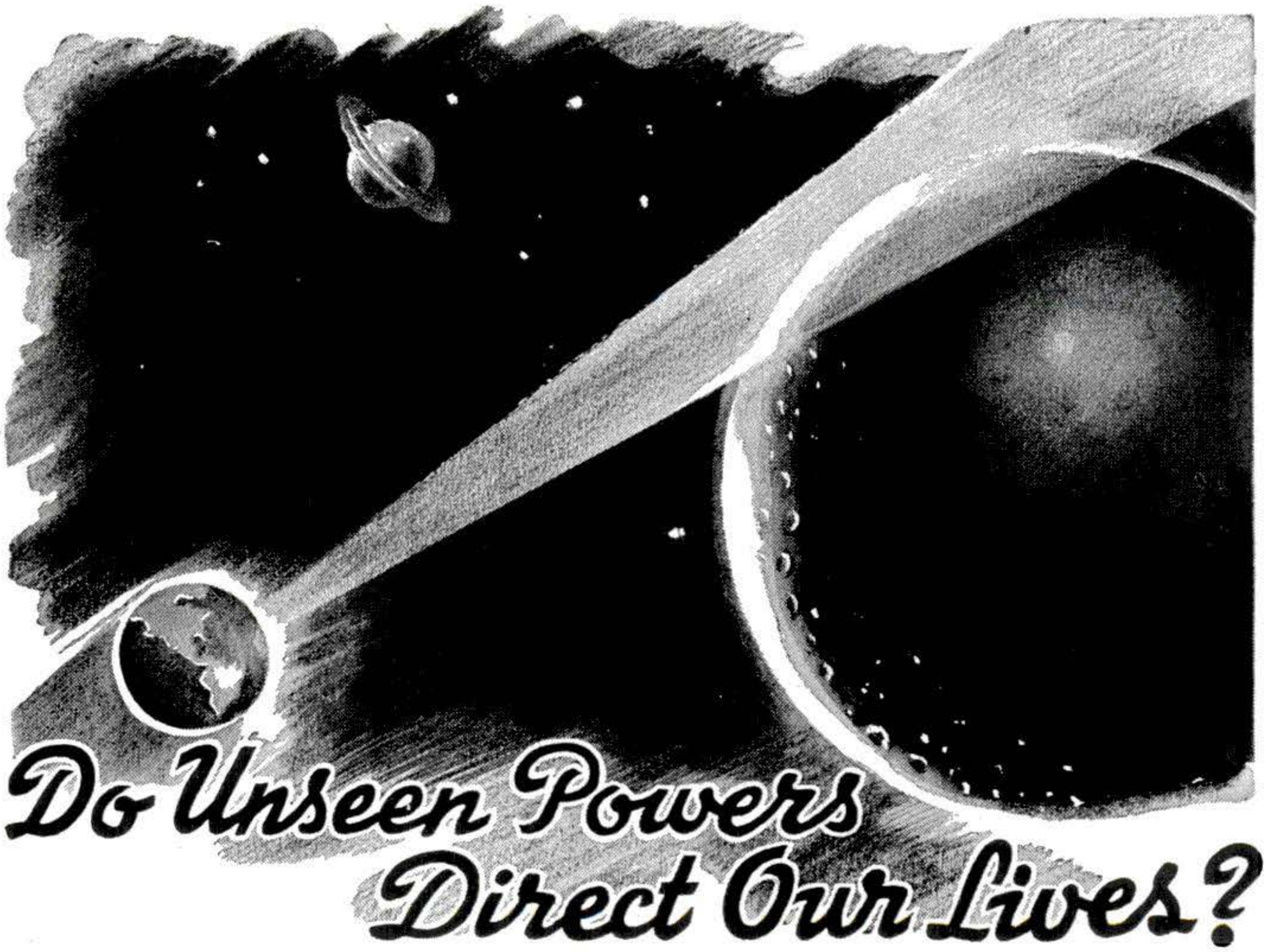

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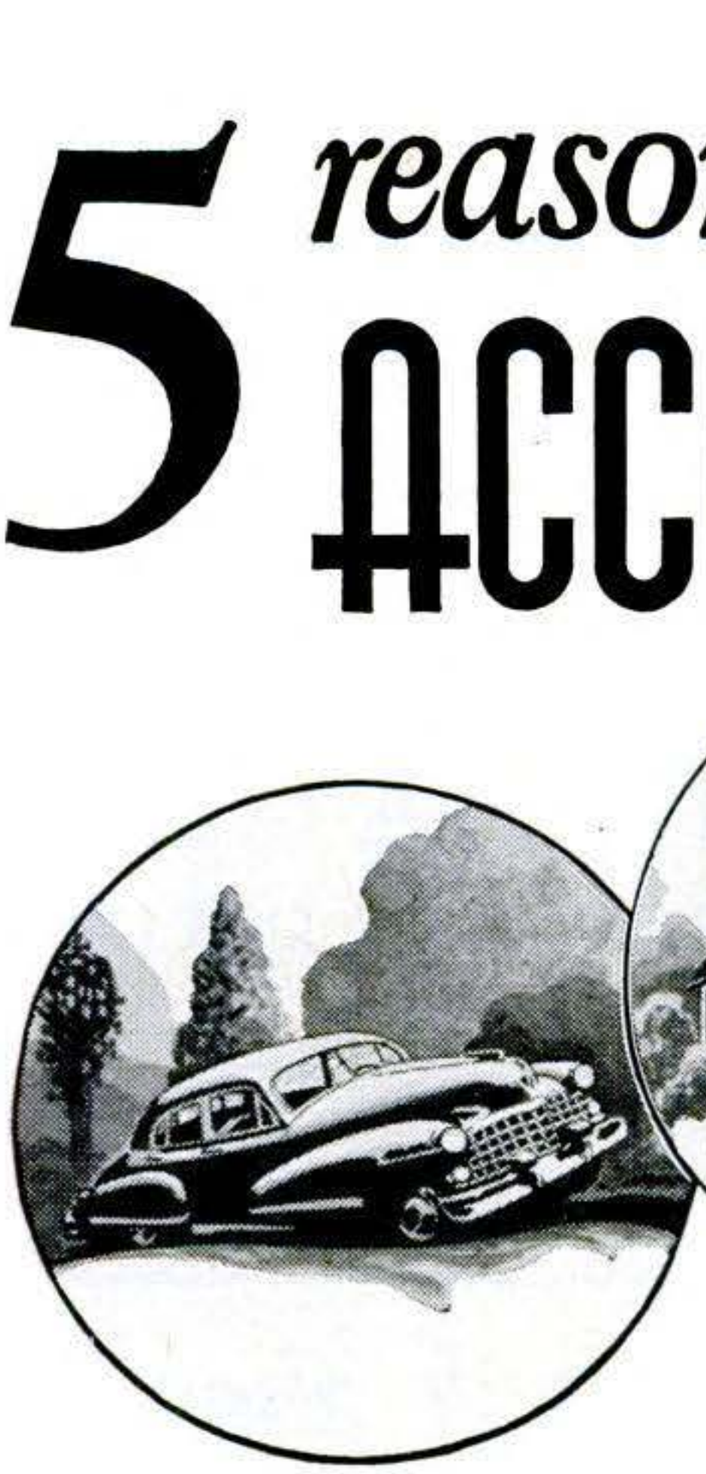

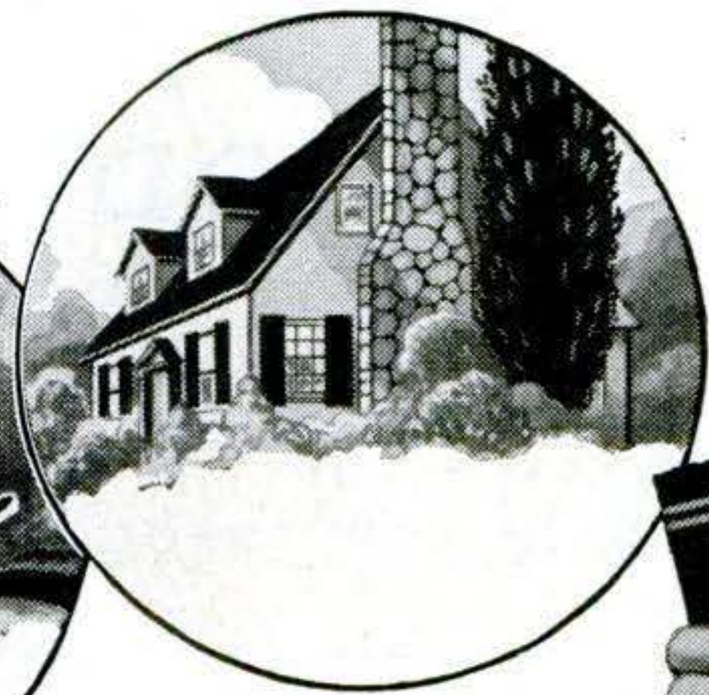

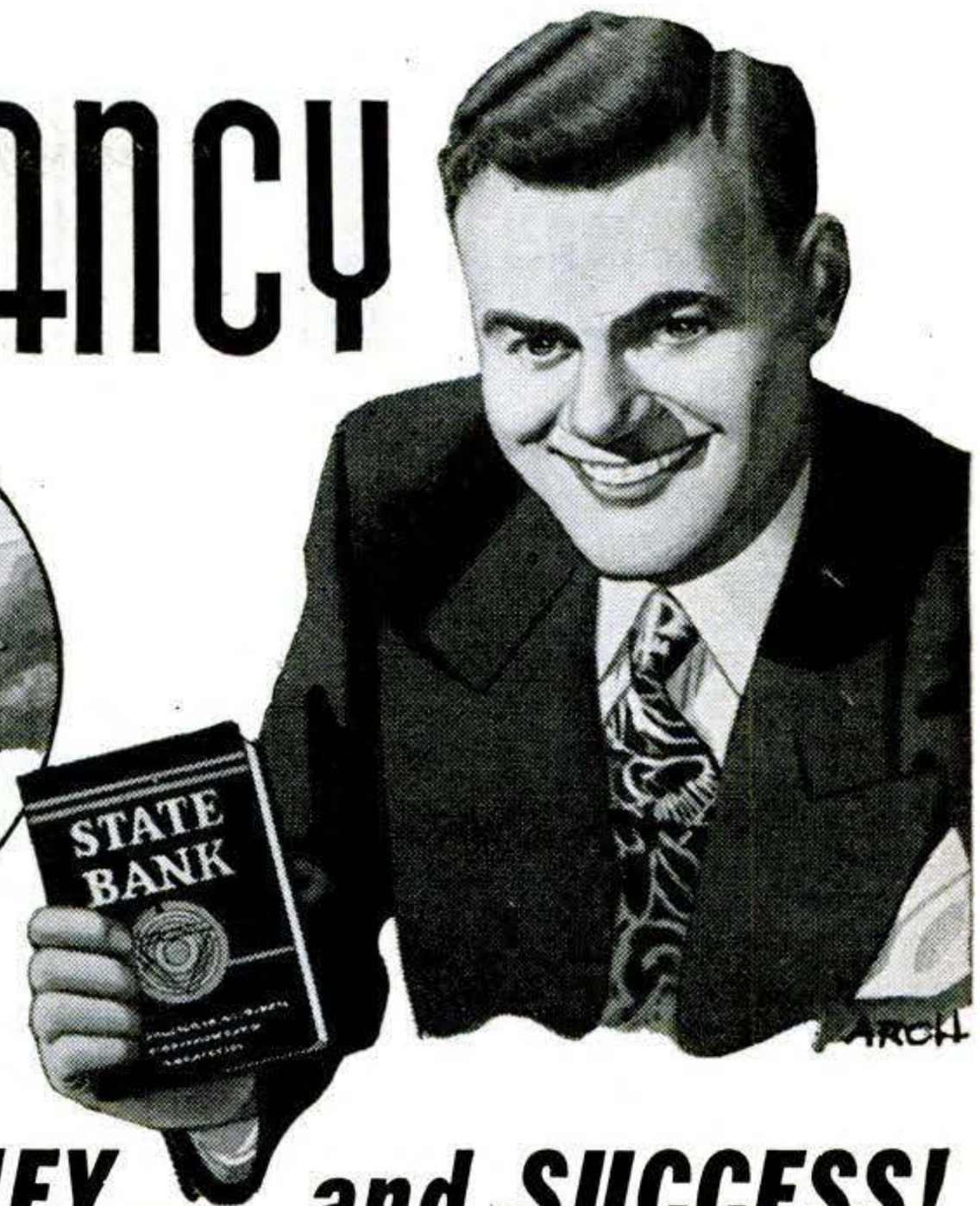

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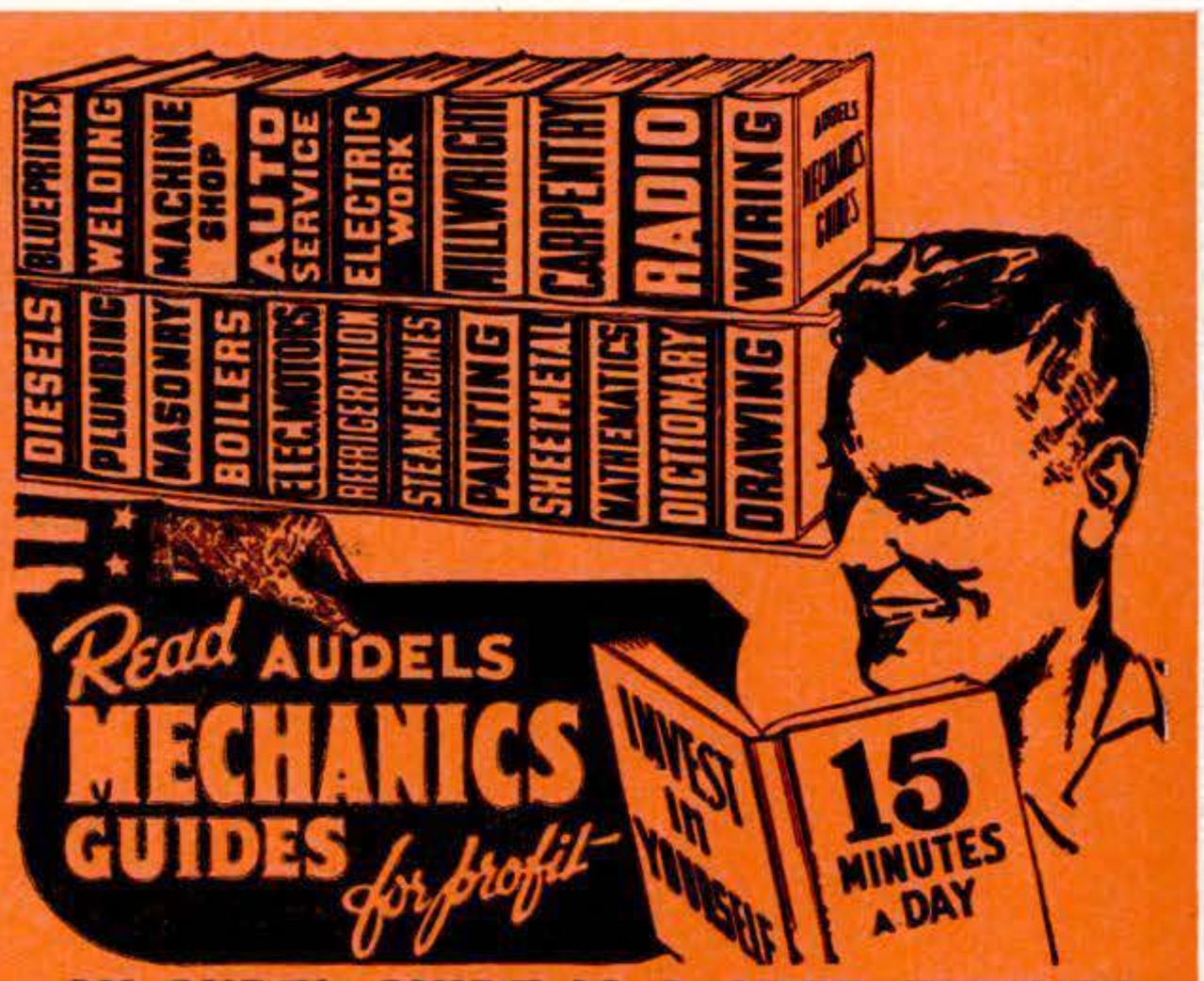

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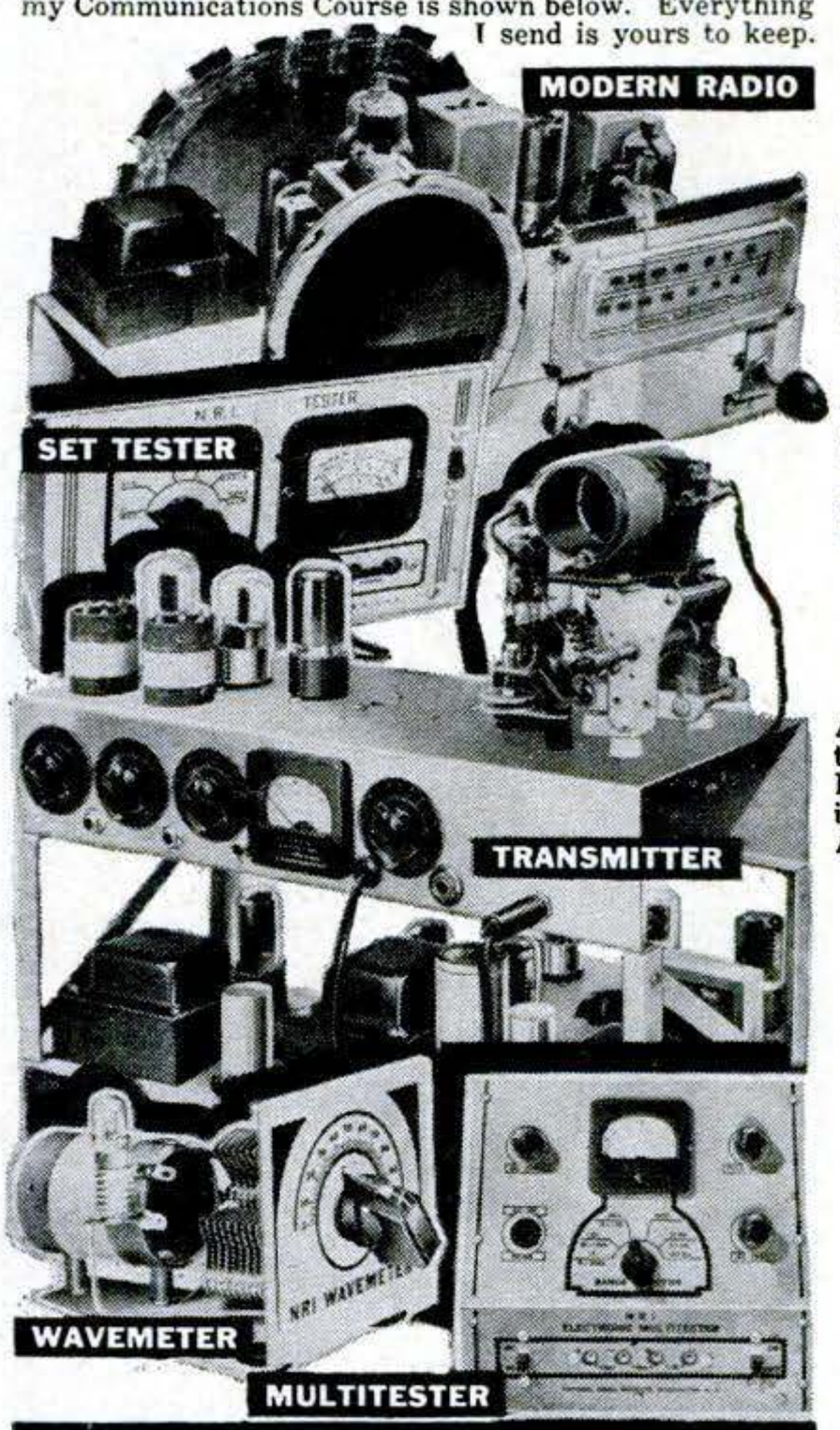

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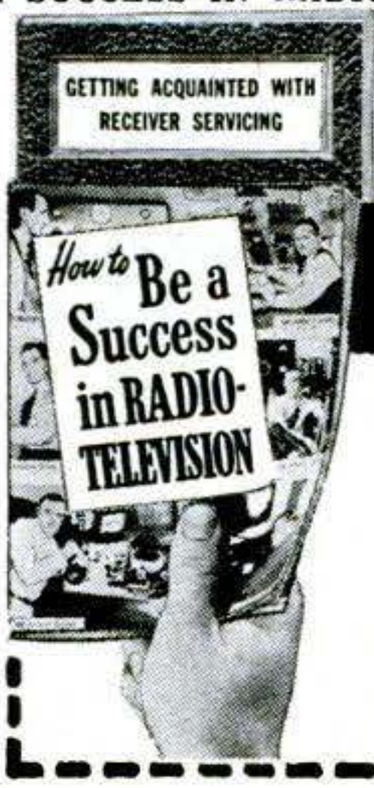

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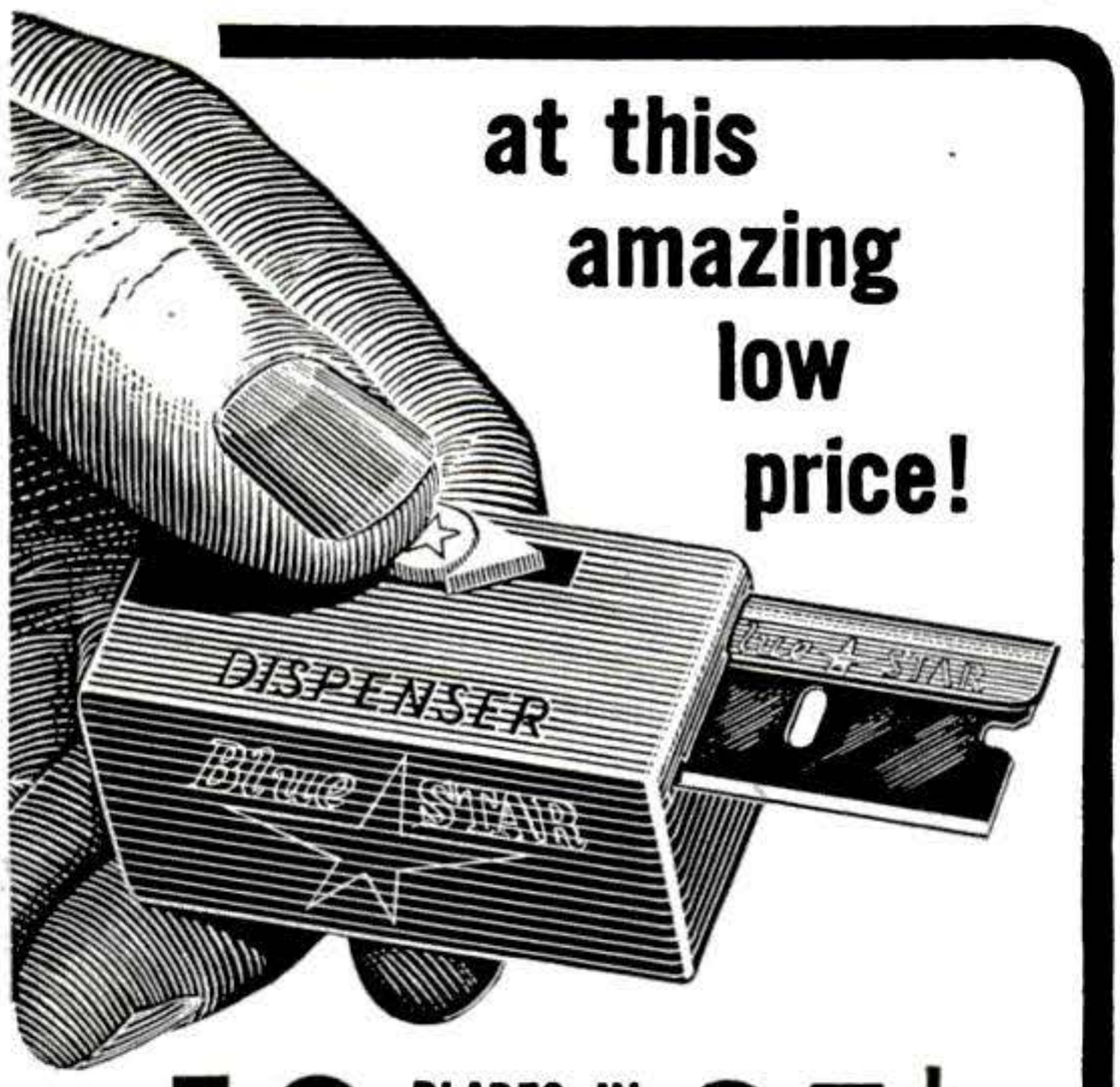

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HARRY GRAHL

Bronx, N. Y.

Sir:

Thanks for the article on how to "Make Your Own Geiger Counter." We're much interested in building such an instrument for our electrical classes.

WALTER R. HOBBS, JR.
Instructor, Senior High School

Battle Creek, Mich.

Sir:

. . . the very article I sought—an up-to-date circuit design.

DAN R. DAVIS

Agricultural and Mechanical College, College Station, Texas

Sir:

For prospecting, could the counter tube be used in a probe?

MORLEY MULLIETTE

Toronto, Ont.

The whole instrument can be enclosed in a box and still be light and compact enough for one-hand use, much the same as a probe. However, an extension probe can be used if you prefer. Simply connect the counter tube to the set by a short length of flexible, rubber-covered, two-wire cable. Enclose the tube in a plastic or metal sheath for protection in handling.

It Glitters—But Isn't Metal

Sir:

In PS for March, p. 128, reference is made to silicon *metal*. In Lange's Handbook of Chemistry, silicon is not listed as a metal; in fact, your magazine seems to have established a precedent. Is silicon still classified

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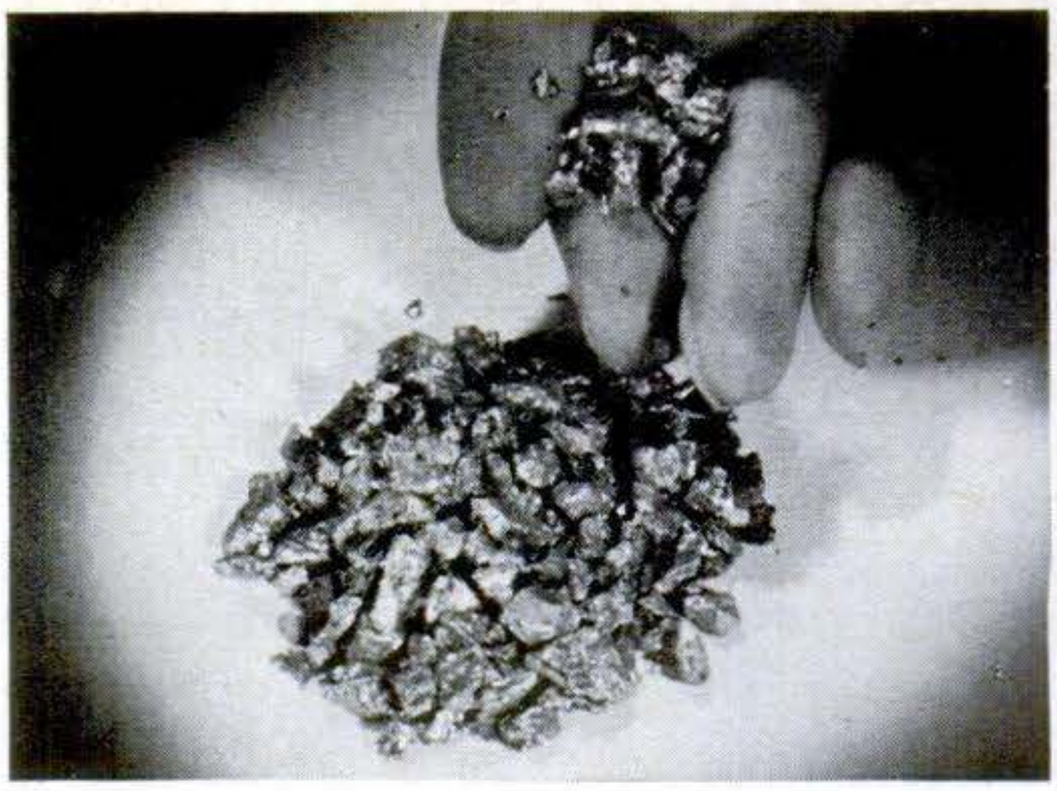

as a non-metallic element, or has its classification been changed?

MAURICE E. ARMENTROUT

Greenville, N. C.

A report on silicon lenses for infrared rays, received from a usually accurate source and incorporated into a PS article, erred in calling silicon a metal. Elementary silicon in crystalline form, gray in color, has a bright luster resembling that of a metal (see photo above). But the chemical properties of silicon clearly establish it as a non-metallic element.

Quick Service

Sir:

I'd like to see them make: a telephone directory with a thumb index like a dictionary.

CHRISTINE LAFFERTY

Chester, Pa.

Why wait, when you can easily thumb-index your own? See PS, Aug. '48, p. 163.

Old Idea With a New Twist

Sir:

In your February issue, p. 128, there is an interesting article entitled "Water Jet Propels Boats." It seems to me that the method of propulsion used is the same as that used by John Rumsey in 1786 when he drove a boat at a speed of four miles an hour at Shepherdstown, W. Va., in which a steam pump forced a jet of water aft.

ARTHUR EDMONDS

Encinitas, Calif.

Right, except for details. It was James *Rumsey, and according to the "Dictionary of Biography," he demonstrated his craft on*

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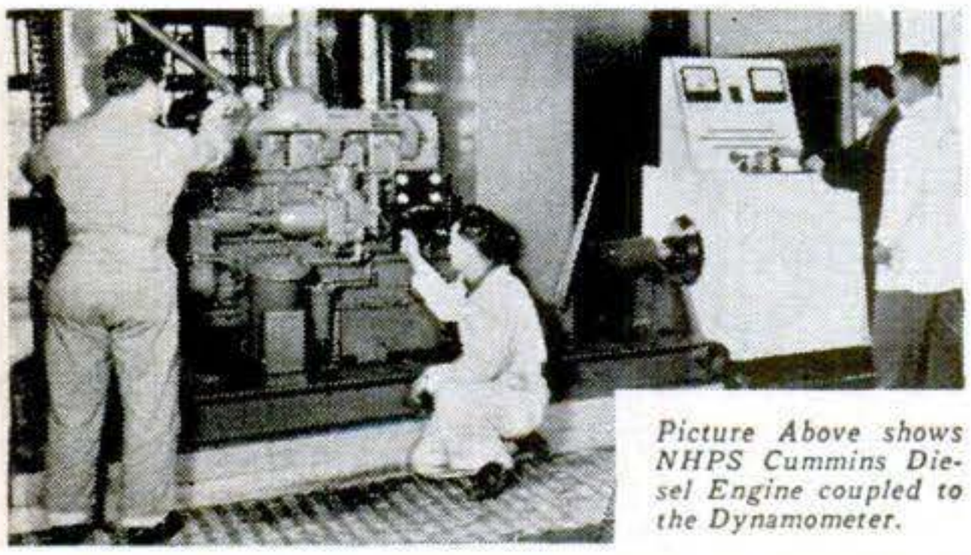

Picture Above shows NHPS Cummins Diesel Engine coupled to the Dynamometer.

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the Potomac River for George Washington and others on Dec. 3 and 11, 1787. PS, always careful, did not say that the principle was new—only its current application in experimental shallow-water craft for the Navy and Air Force, in which the water jet takes the place of both propeller and rudder.

Memo to Detroit

Sir:

Think back and ask yourself, What was the best car ever manufactured? What old model is still on the road today and still in great demand?

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ALBERT A. JOHNSON

Mt. Holly, N. J.

Objection Overruled

Sir:

Your article on "Tricks of Master Shipbuilders" [Jan., p. 186] shows a wheel used on some sailing ships, as viewed—the caption says—from the port side. Wouldn't the steersman face the bow? Which would make your drawing a view from the starboard side.

W. GRAHAM MILLAR

Buffalo, N. Y.

Our caption stands. In many old ships the wheelbox was aft—behind—the wheel, and the steersman faced forward by standing alongside the wheel rather than facing it.

How Wrong Can We Get?

Sir:

As a former instructor in anti-tank tactics at the Infantry School, Fort Benning, Georgia, and, more especially, as Washington correspondent of POPULAR SCIENCE, it grieves me deeply to see PS, in its March issue, compound an error made in December.

Reference is made to p. 24, Letters department. How wrong can we get?

The British "six-pounder" is actually a 57-mm. gun—in inches, about 2.24. The first American 57s, first used in repelling a German counterattack at Gela, Sicily, were

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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JOHN F. LOOSBROCK
Captain, Infantry, Reserve
Washington, D. C.

Tracking the Stars

Sir:

I'm a bit puzzled by one of the pictures in your January story about how "Grease Rides Mile-Long Roller Coaster." The plant, you say, is owned by Standard Oil of California. But the drum shown being filled at lower left, page 167, seems to carry Texaco's star-shaped trademark.

AL RIPLER
Woodhaven, N. Y.

The two companies, competitors within the U.S., are 50-50 partners in an overseas marketing affiliate, California Texas Oil Company, Ltd. And it's Caltex's trademark, derived from The Texas Co.'s, that you can see on the drum. It's being filled, as our caption noted, for export.

Tip on Filing PS Stories

Sir:

I think I have an idea for other readers who want to keep selected PS articles for handy future reference.

I clip from each issue the pages I want to keep, punch them like loose-leaf notebook pages, and bind them between hard covers with 3-inch stove bolts. I now have seven of these volumes, finished in red leatherette, each on a different general subject.

ROGER BEAULIEU
Terrace Bay, Ont.

Says PS Respects Religion

Sir:

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RICHARD MILES
Palmyra, Pa.

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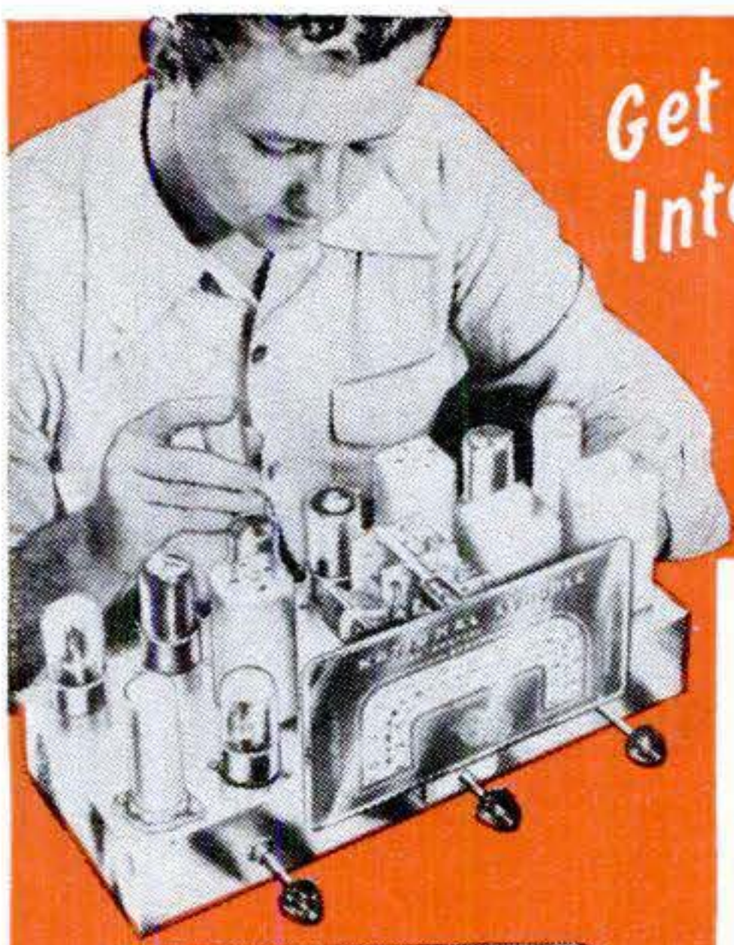

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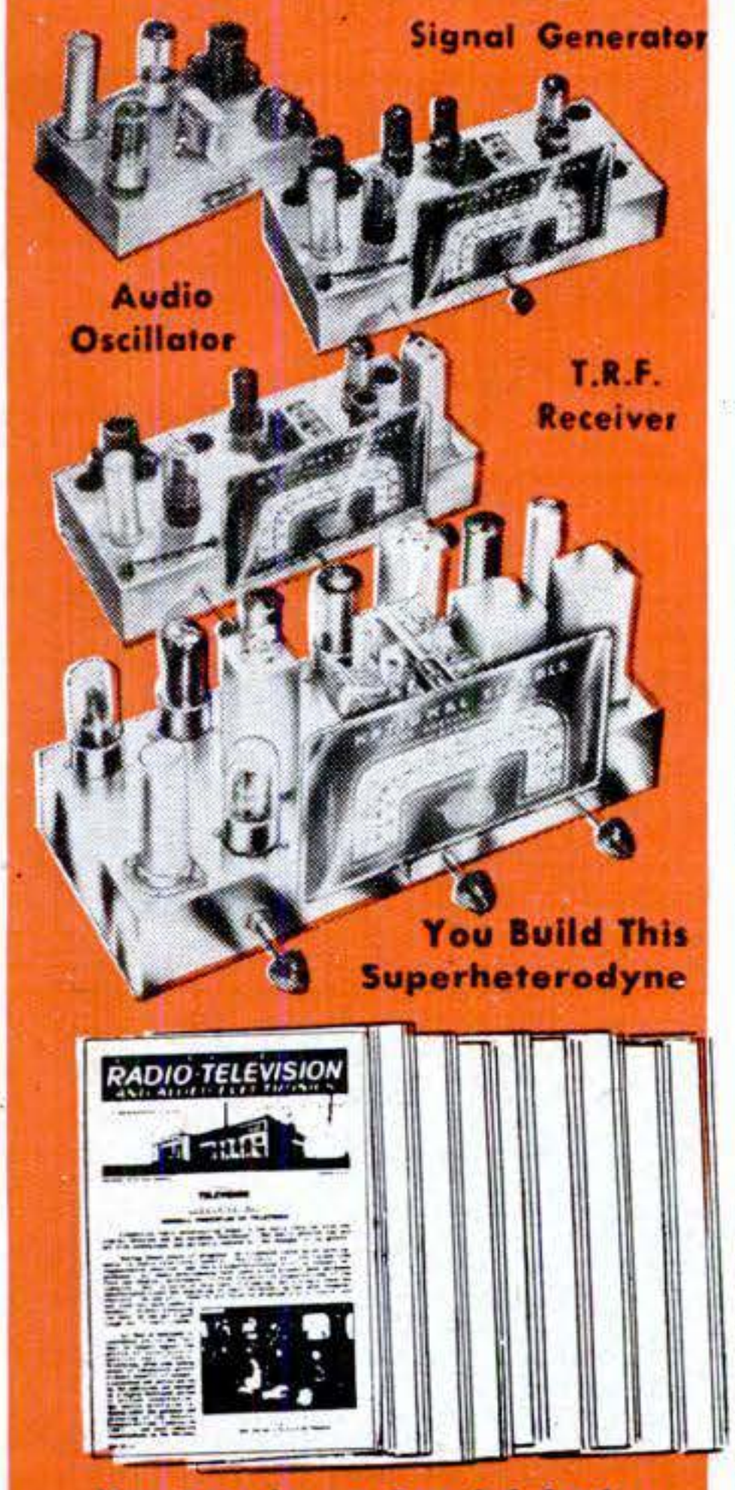

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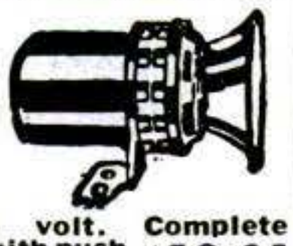

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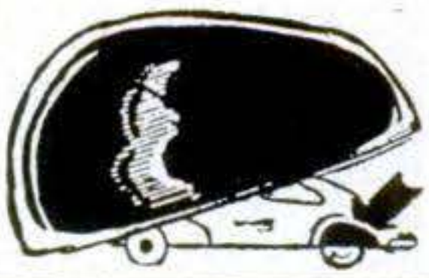

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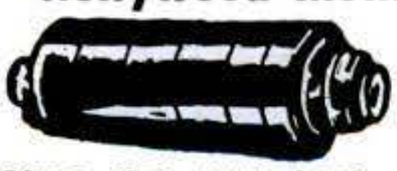

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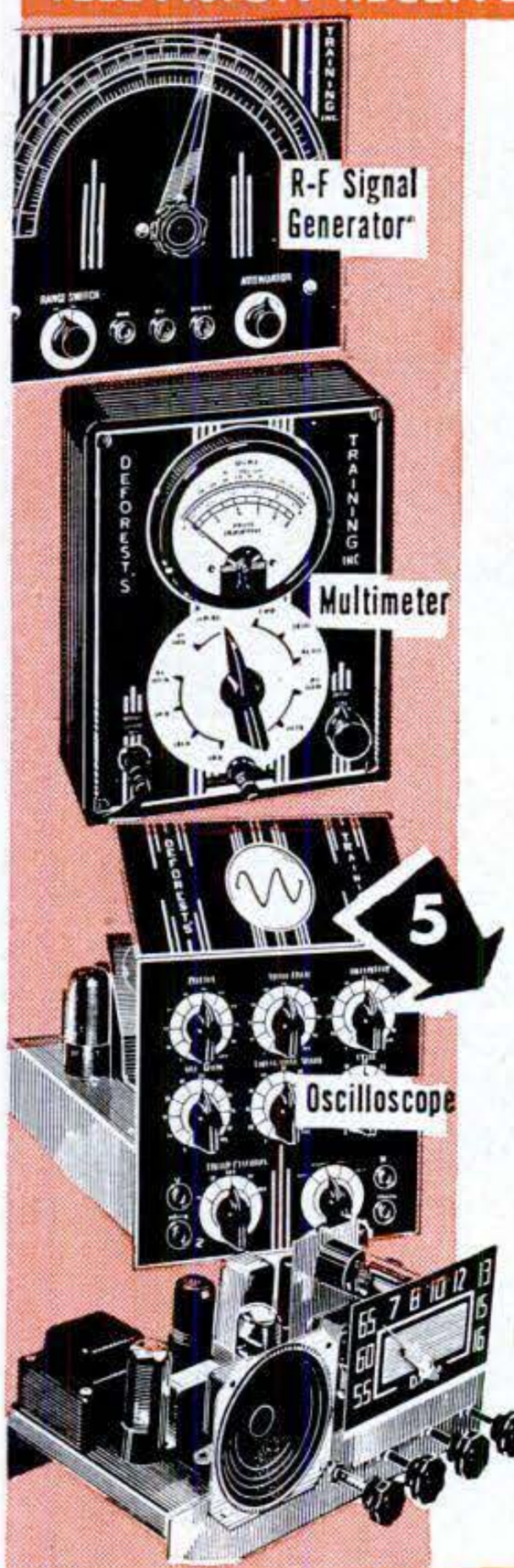

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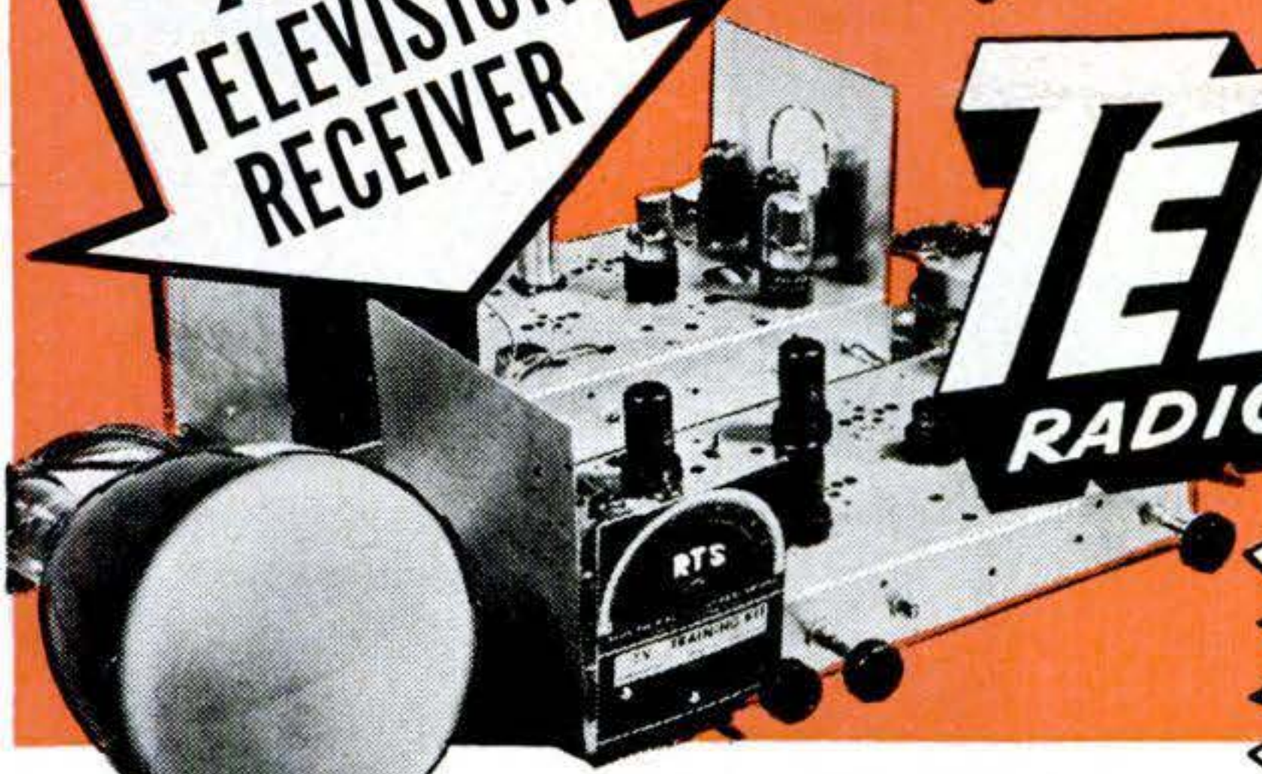

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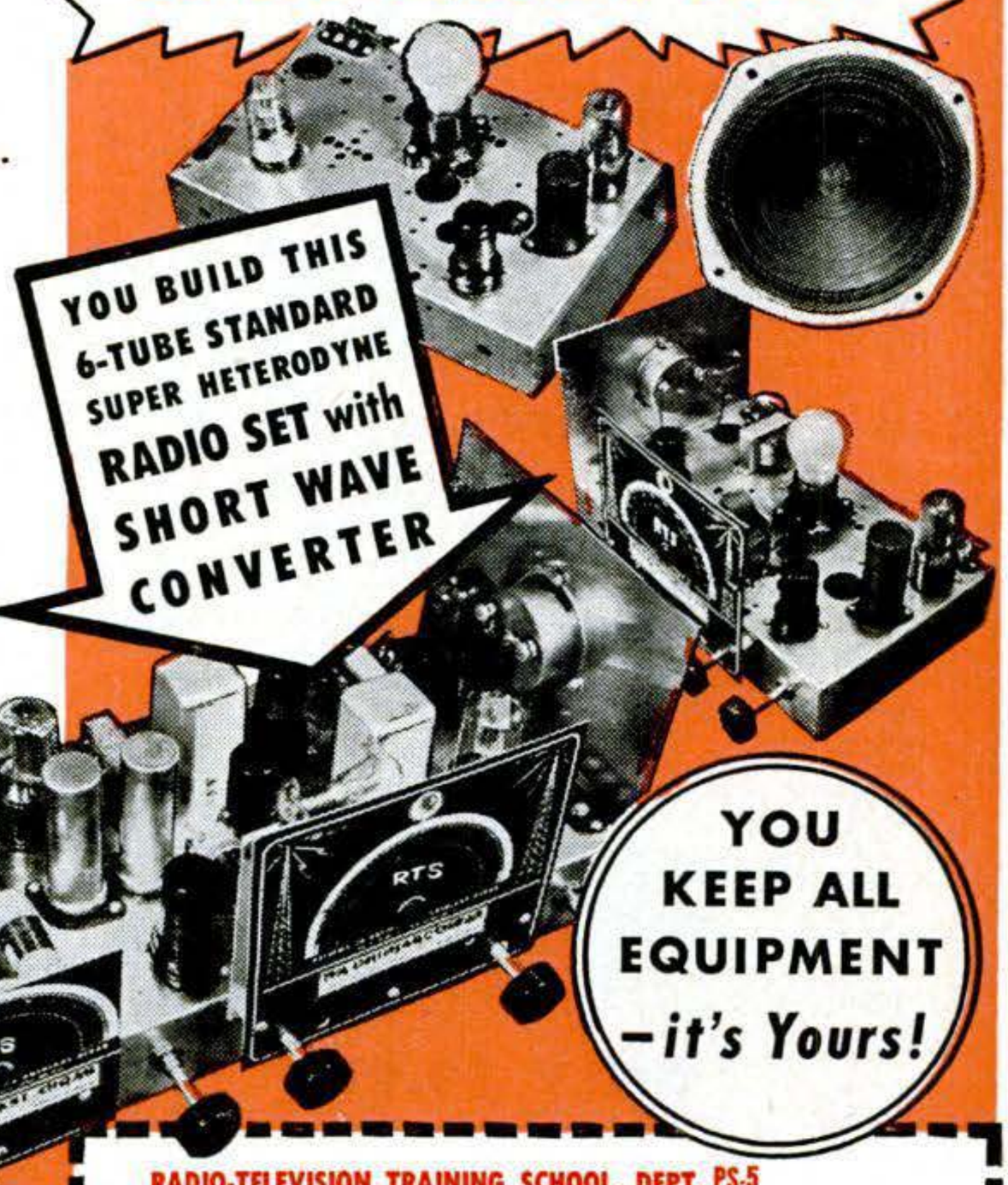

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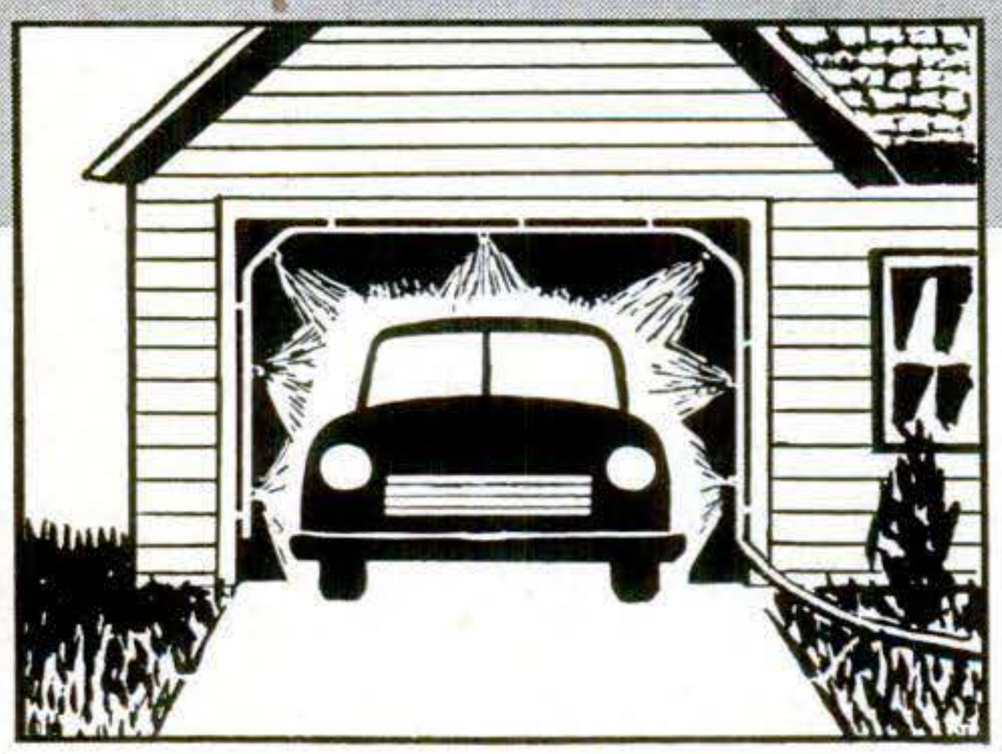

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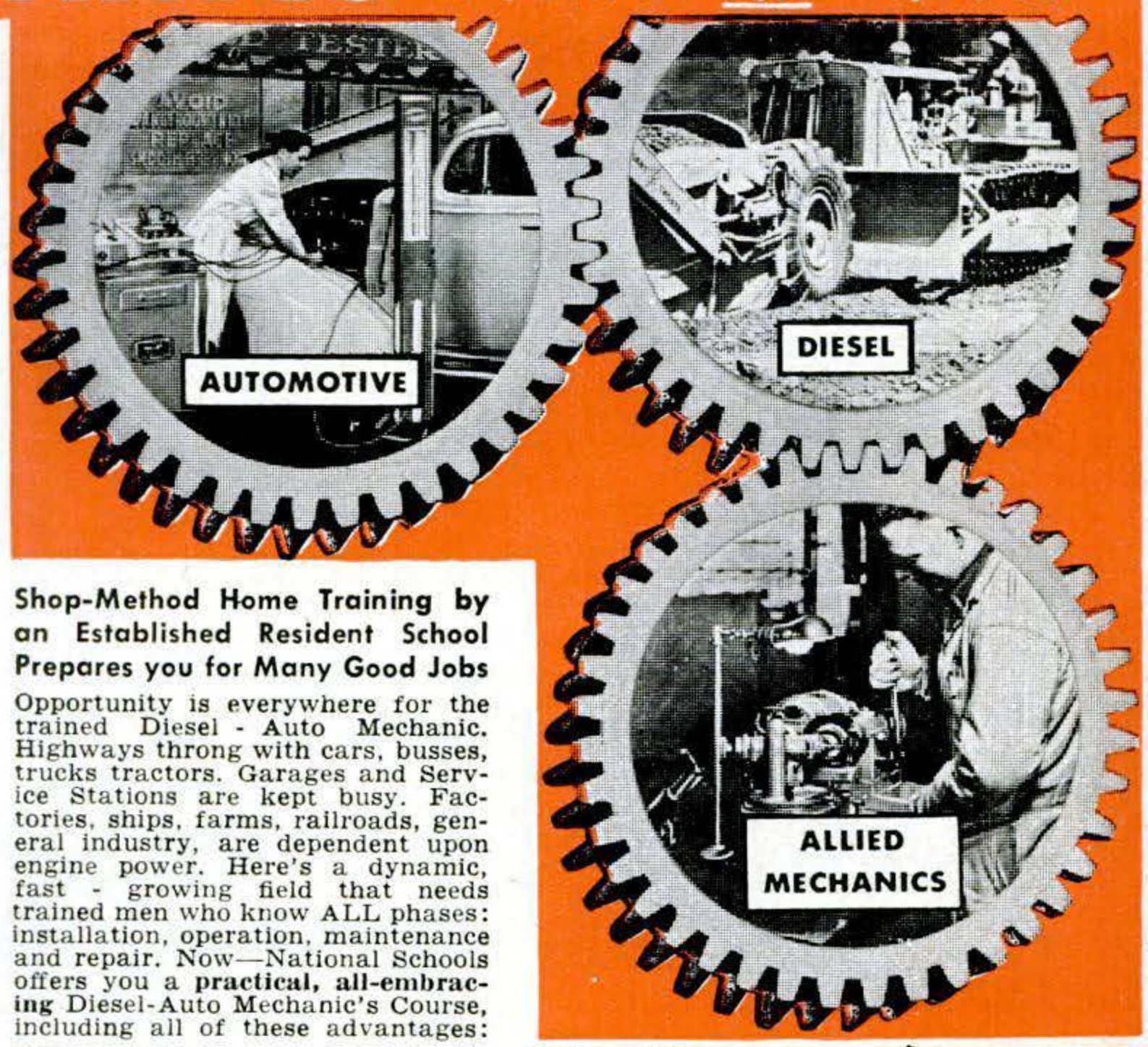

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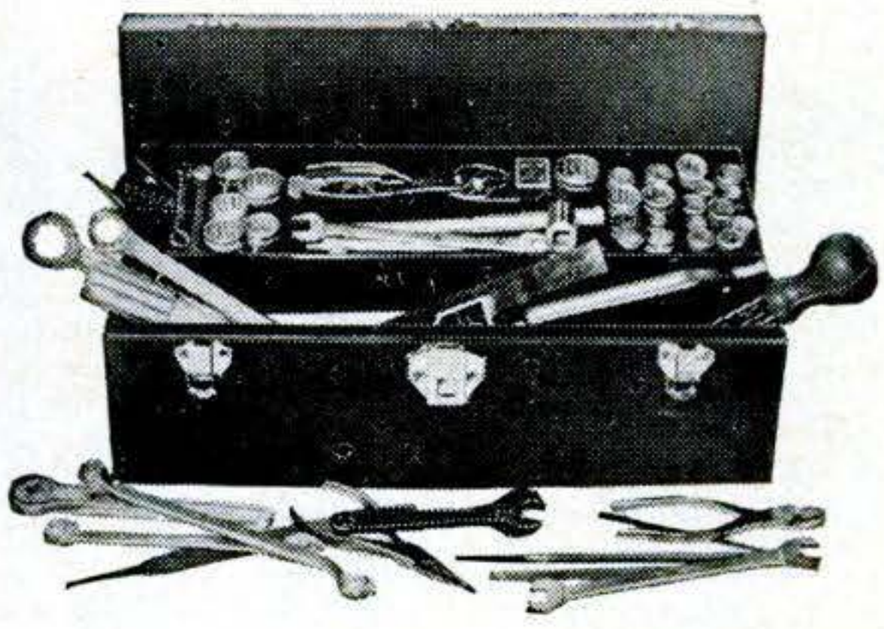

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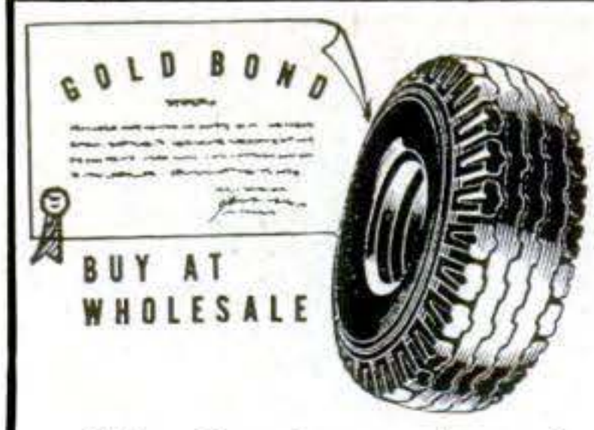

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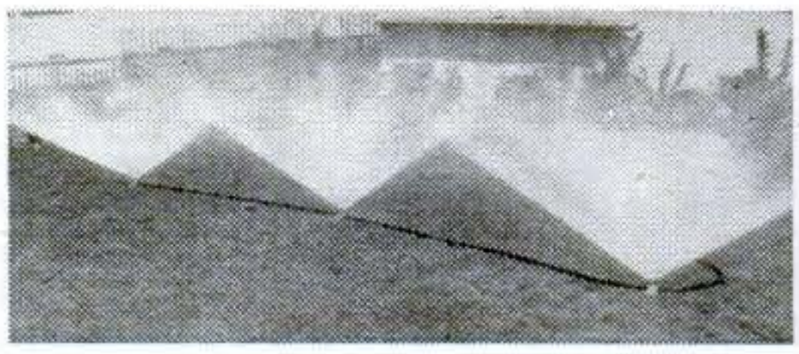

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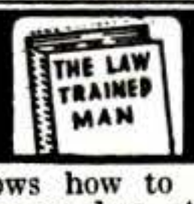

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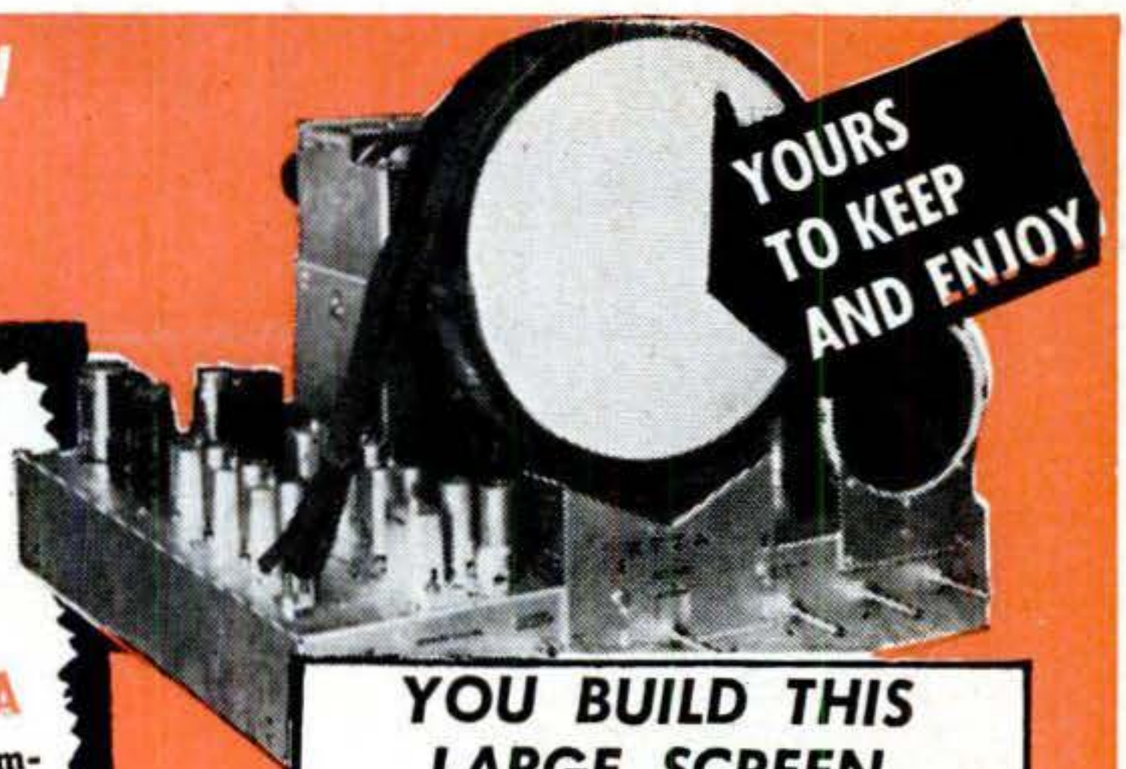

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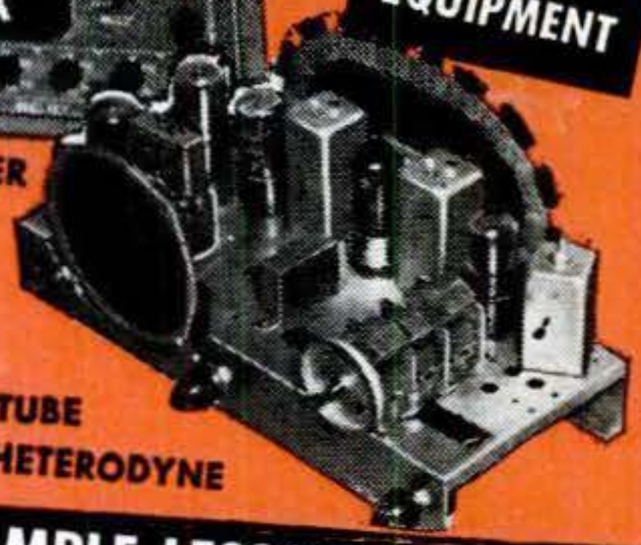

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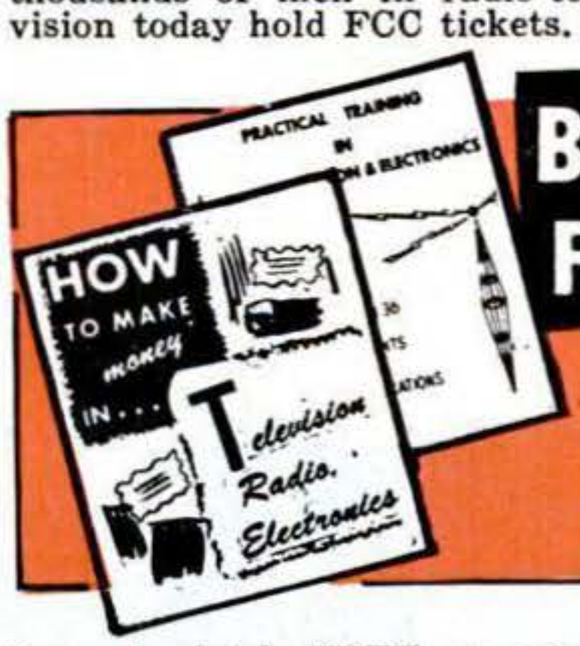

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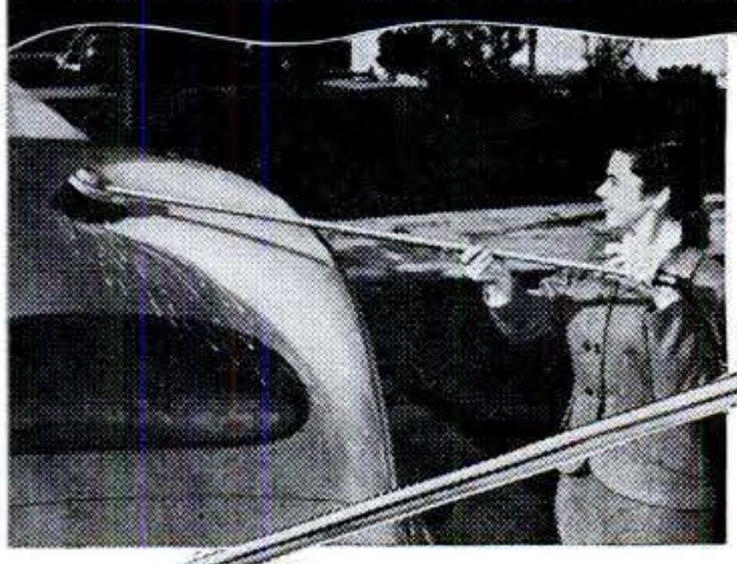

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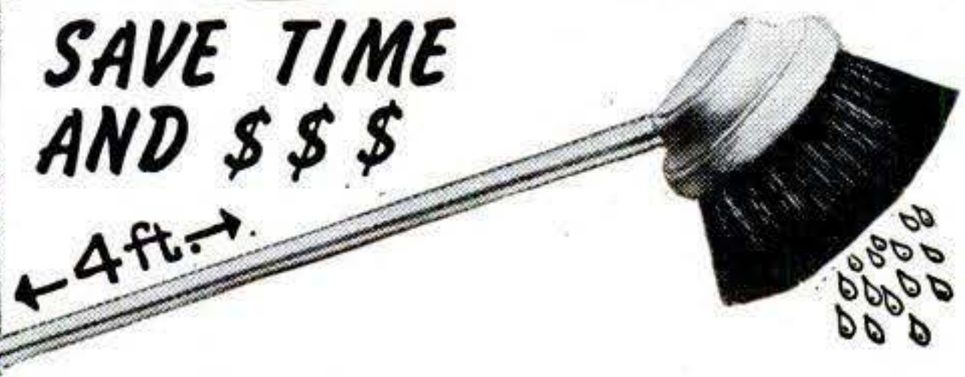

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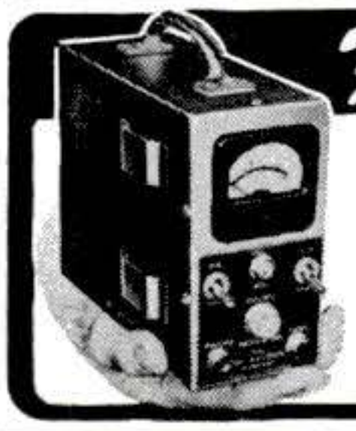

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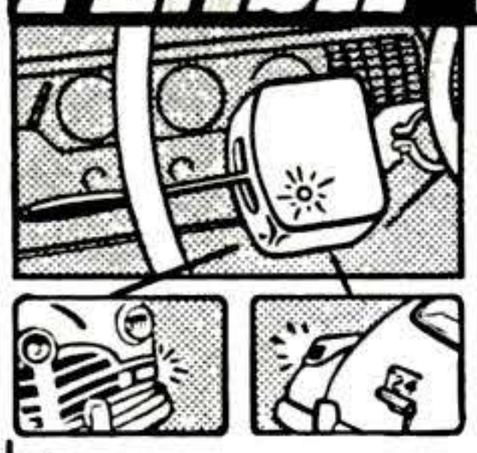

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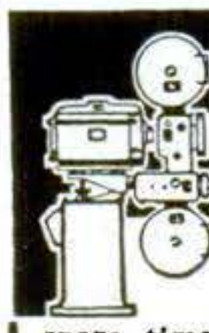

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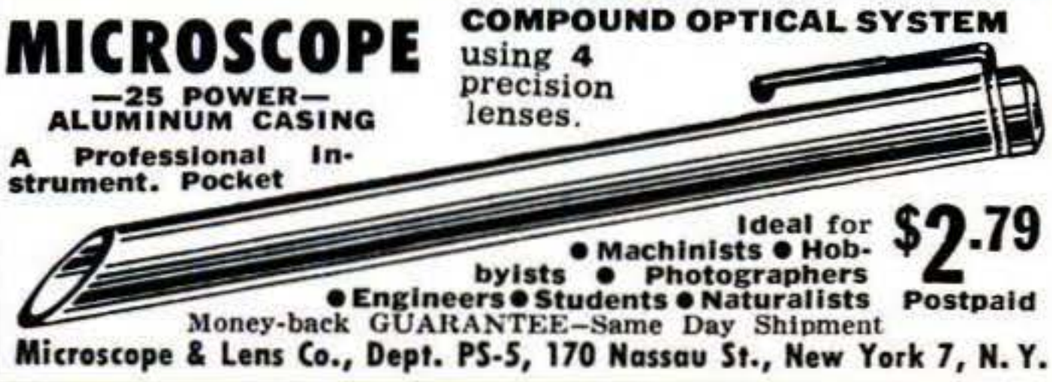

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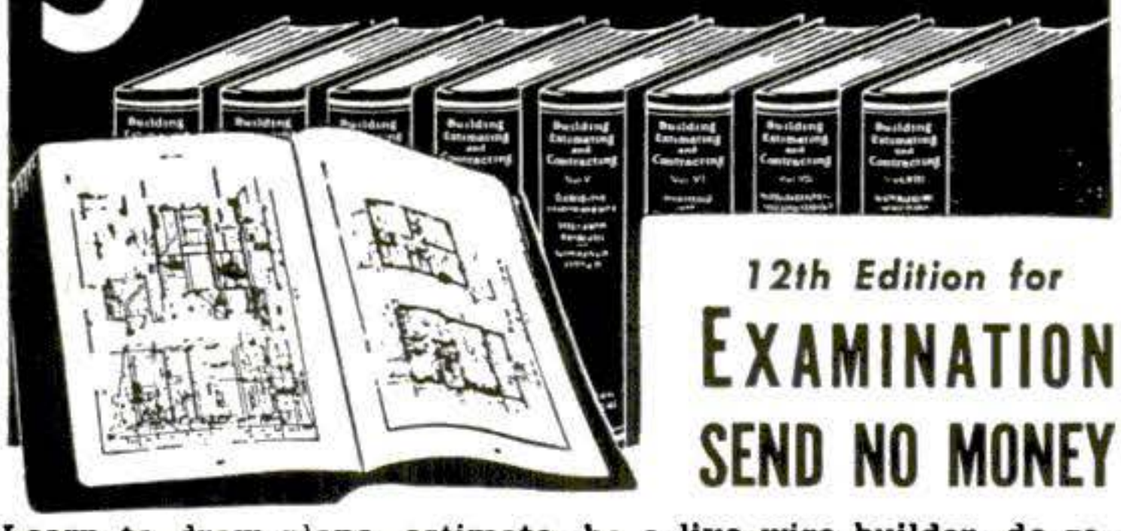

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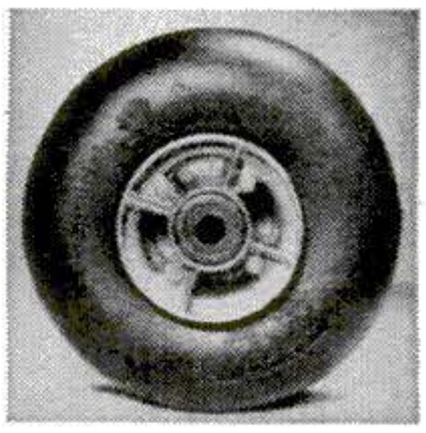

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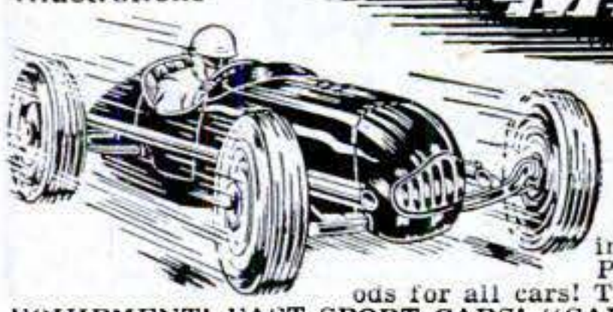

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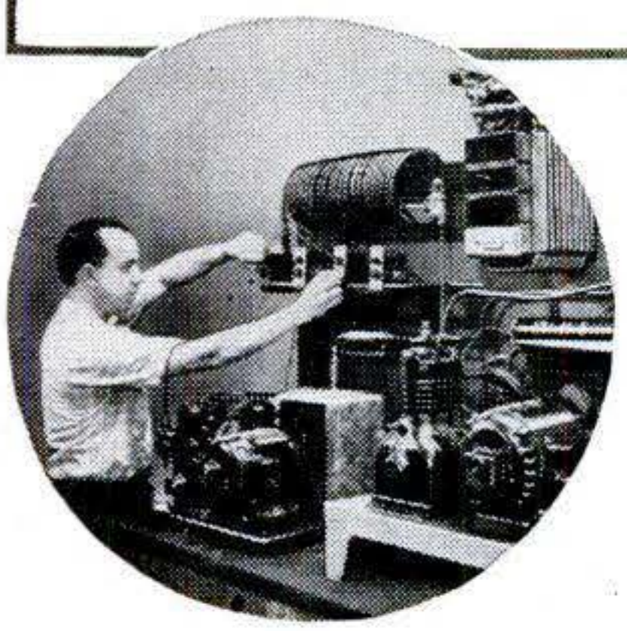

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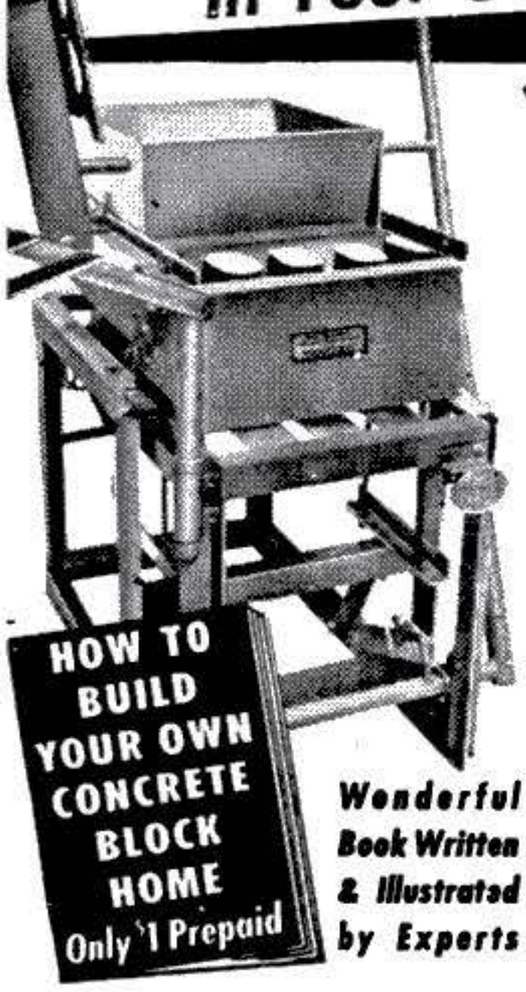

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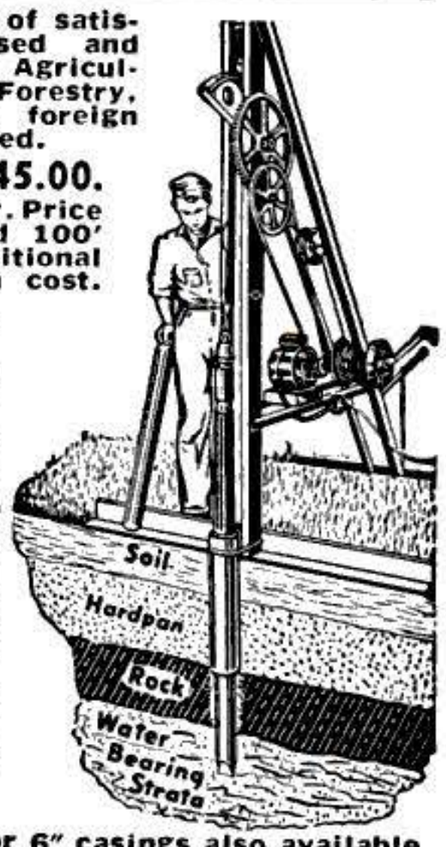

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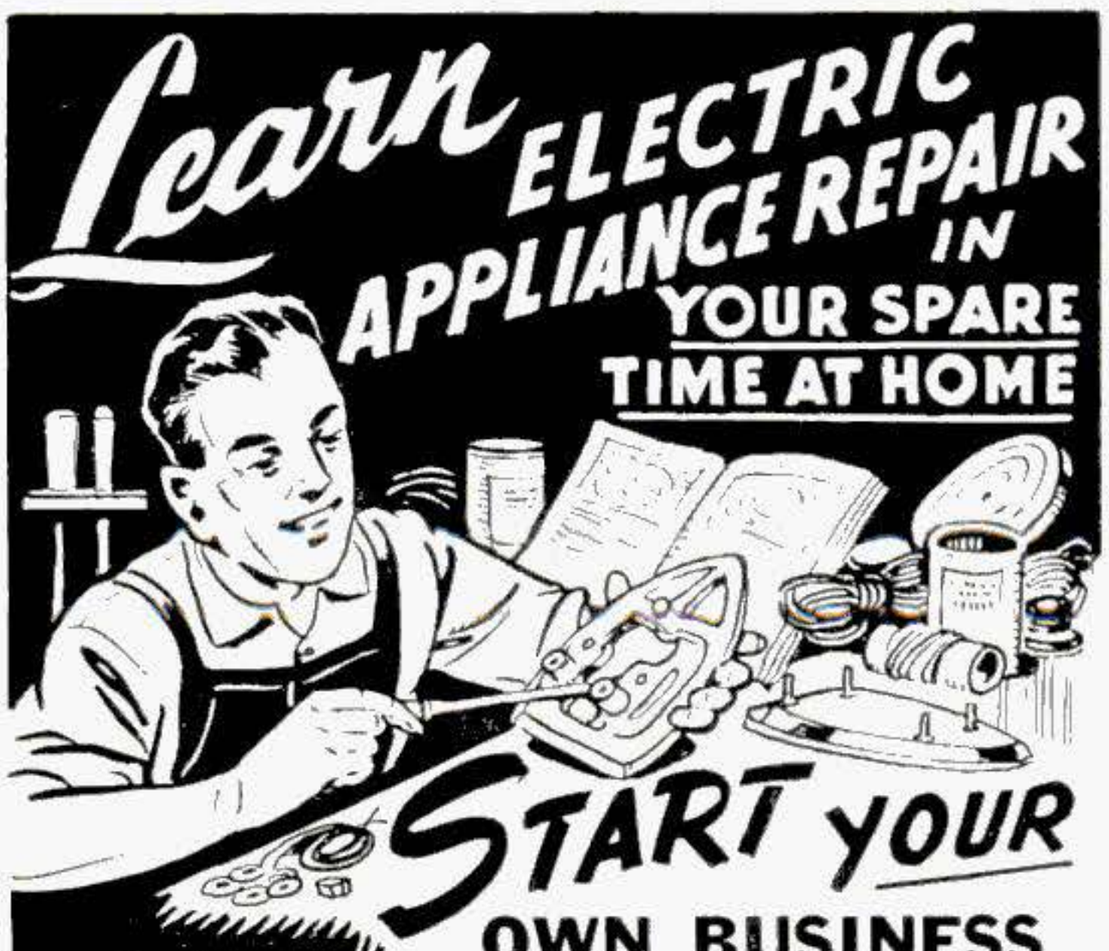

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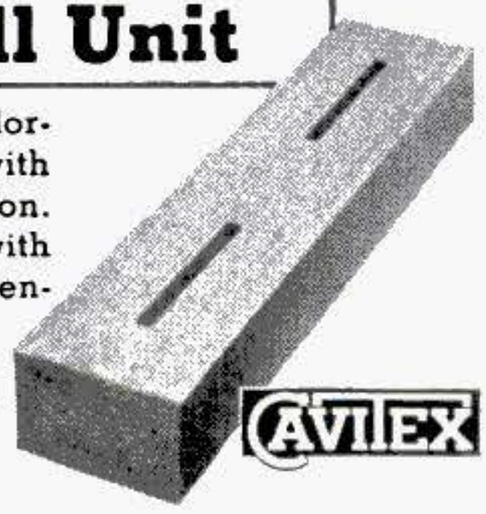

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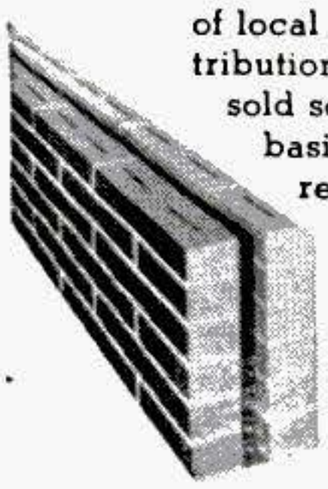

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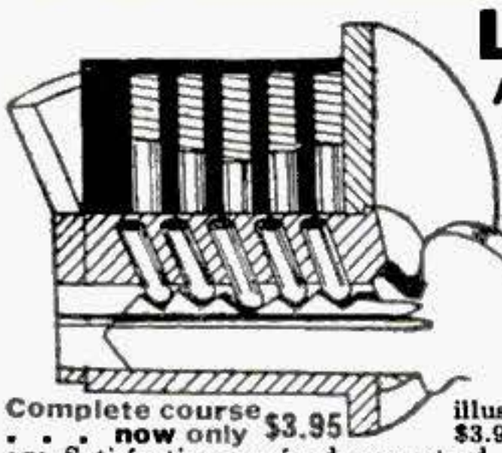

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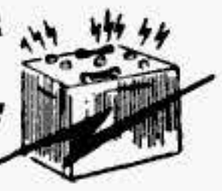

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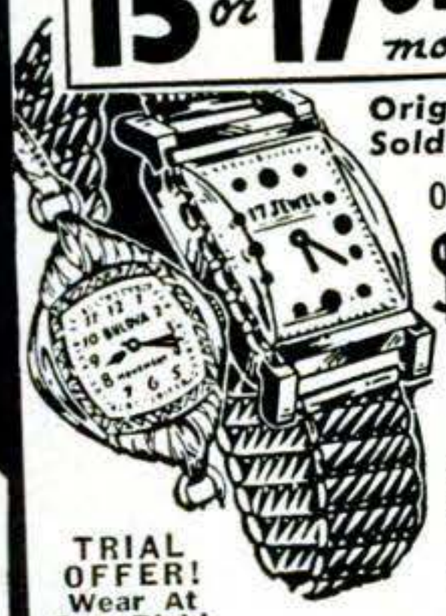

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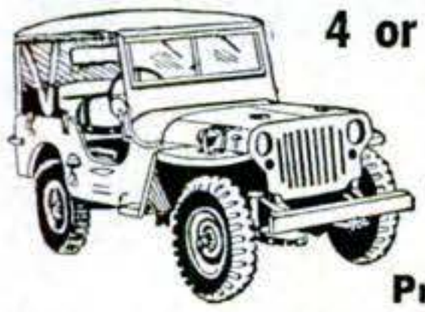

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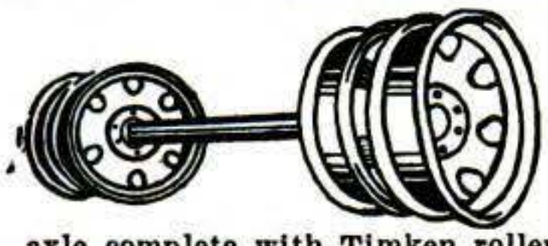

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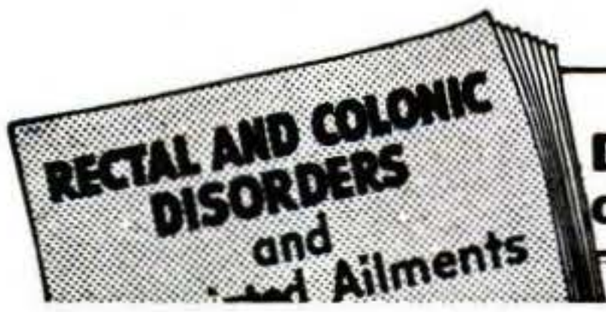

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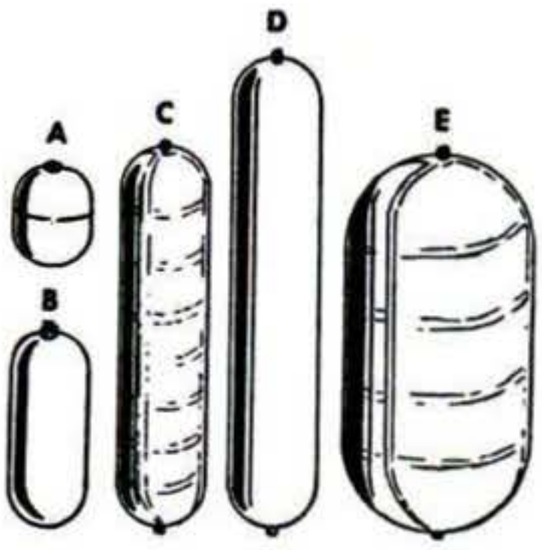

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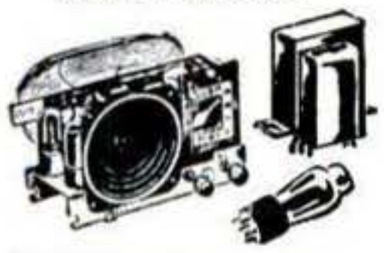

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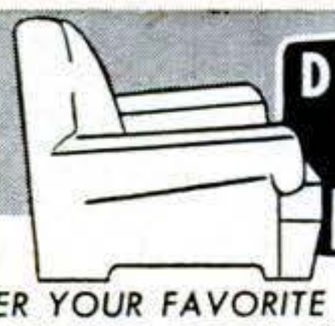

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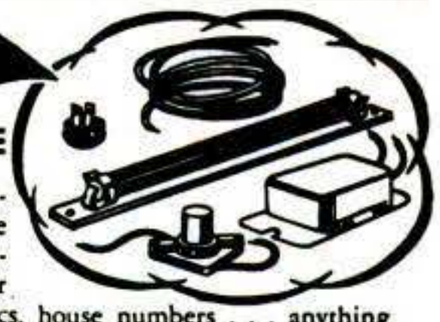

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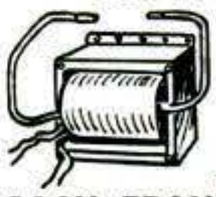

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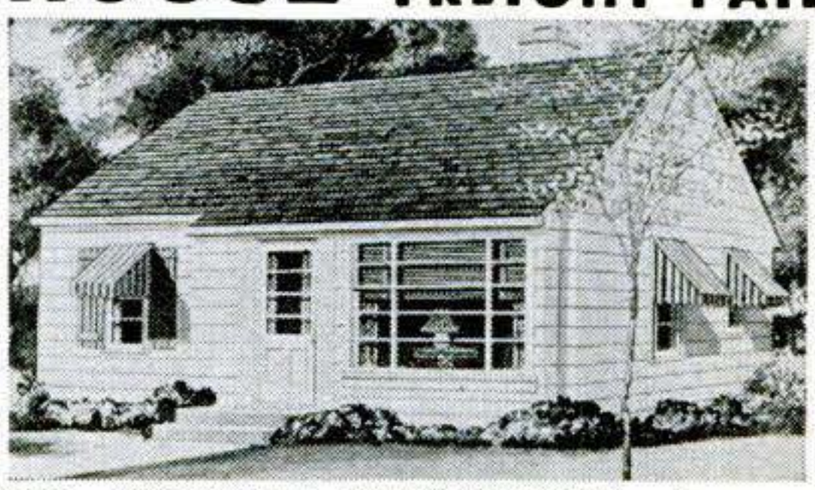

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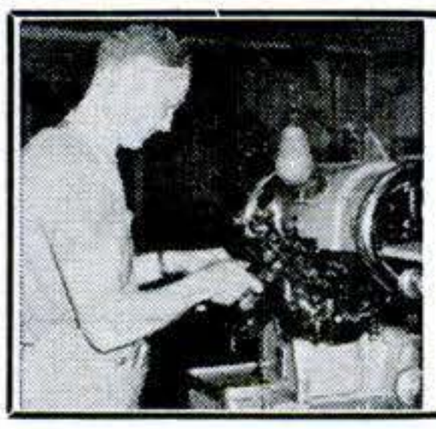

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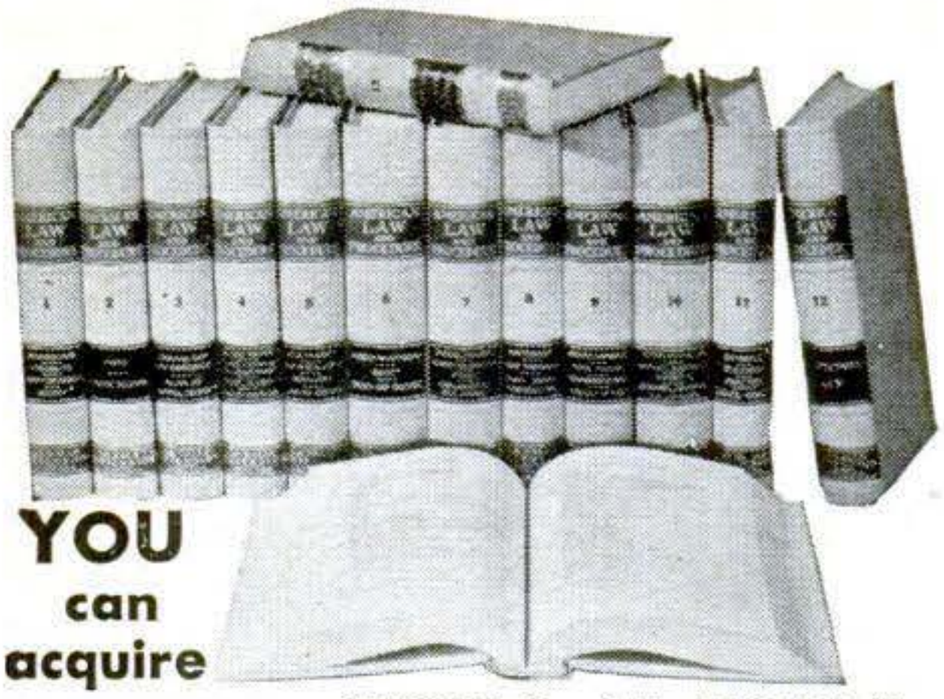

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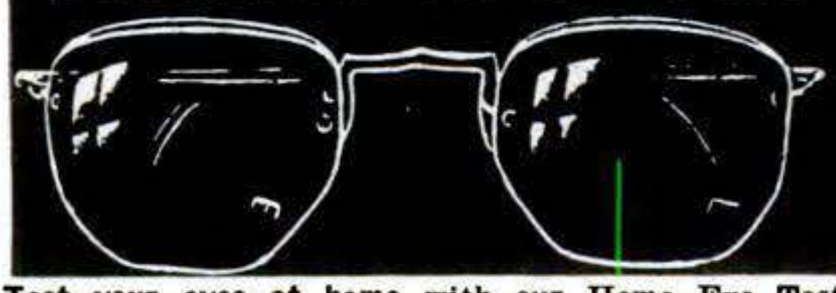

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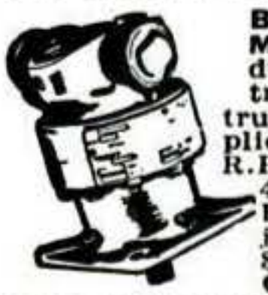

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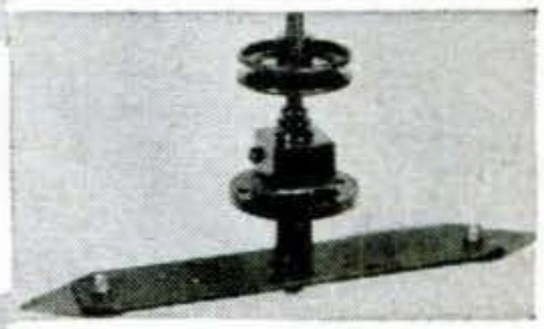

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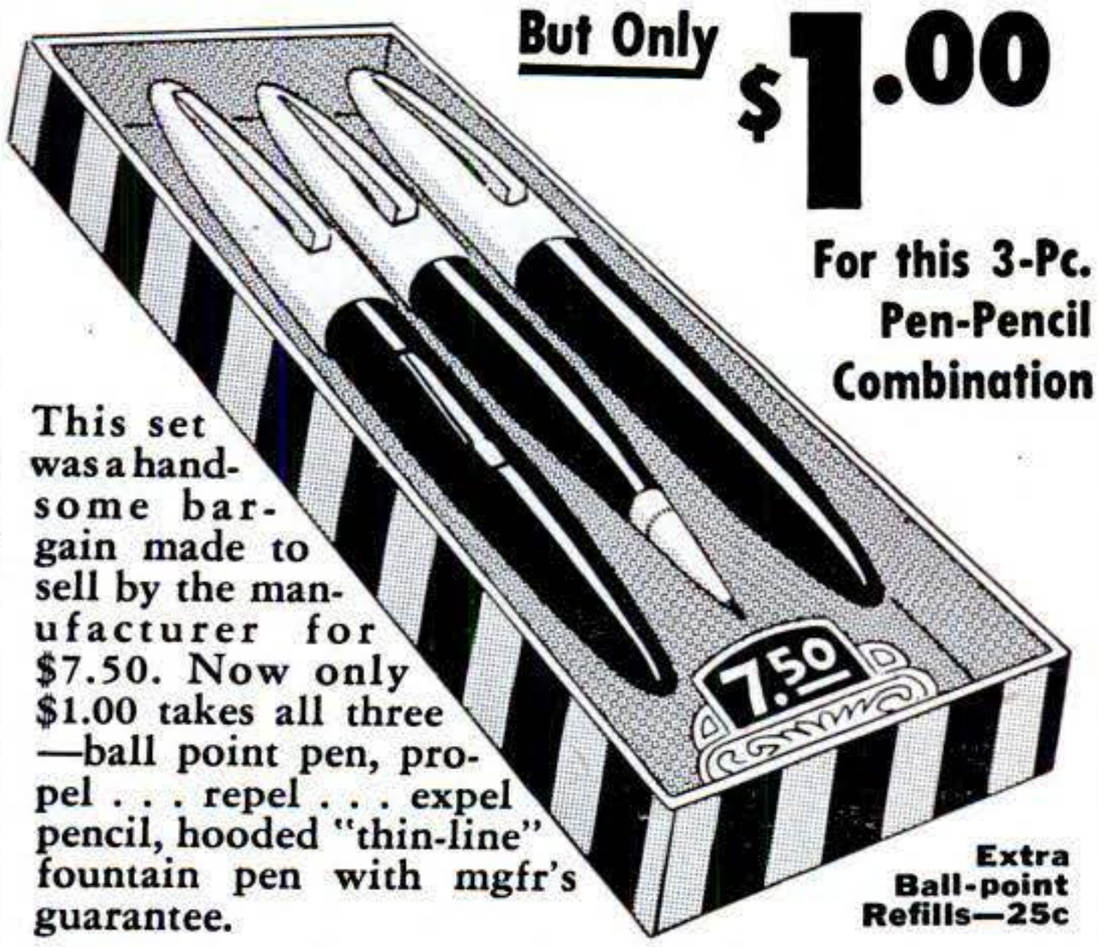

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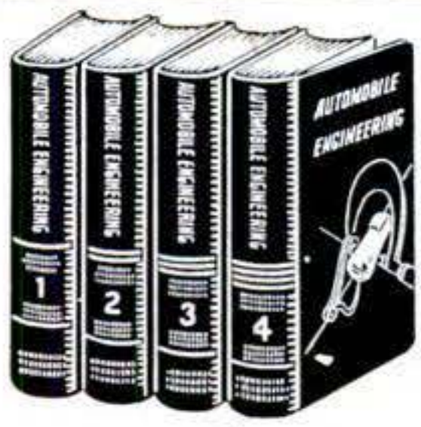

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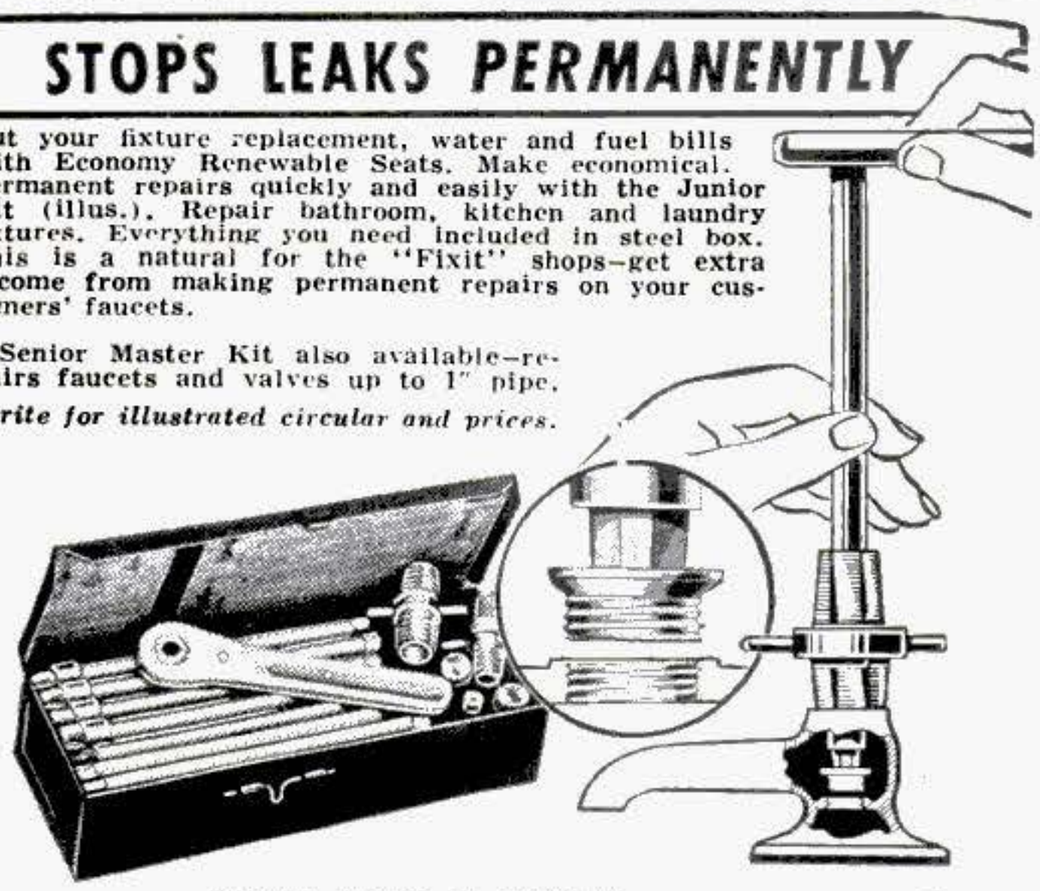

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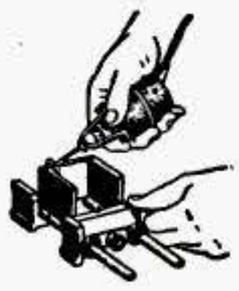

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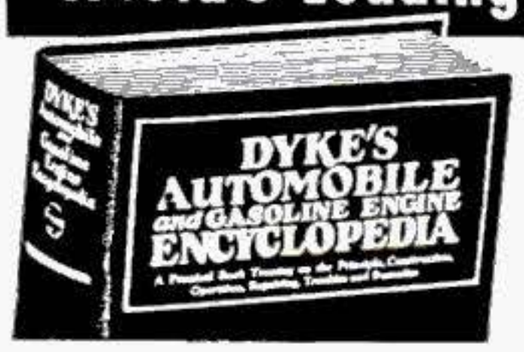

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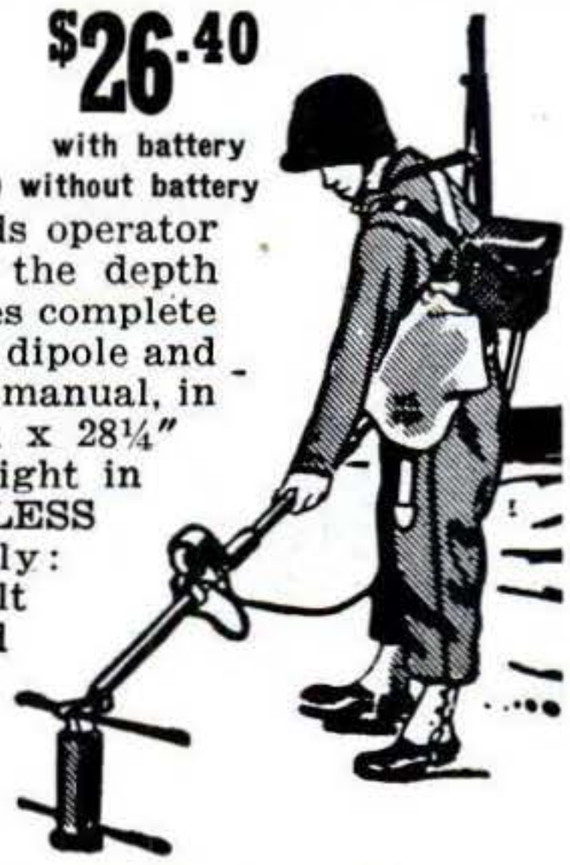

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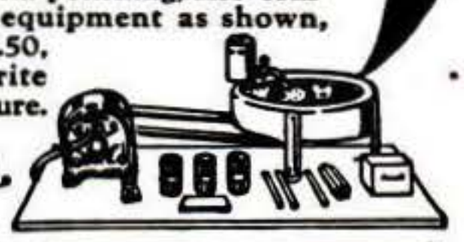

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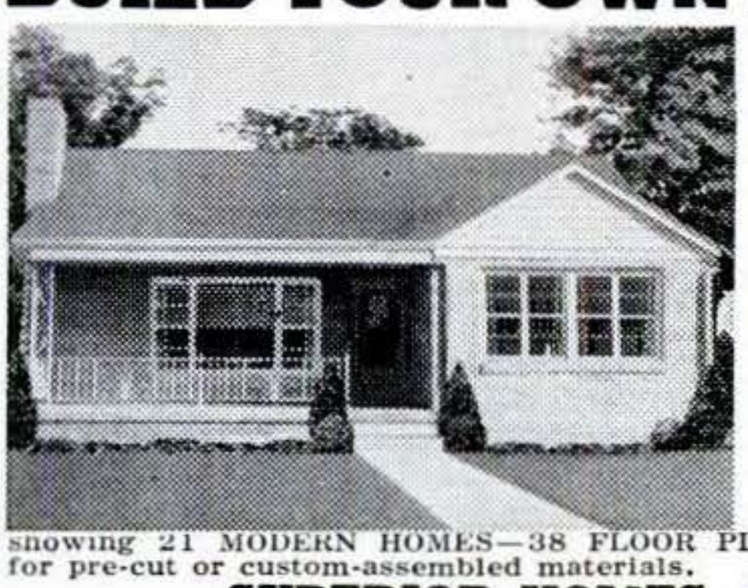

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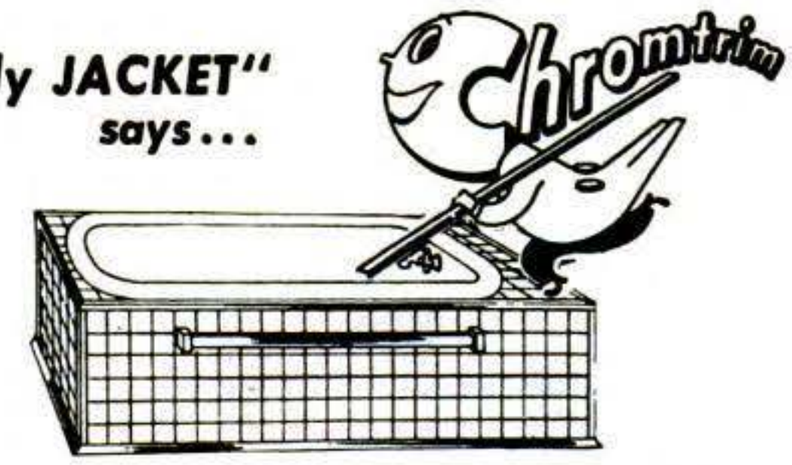

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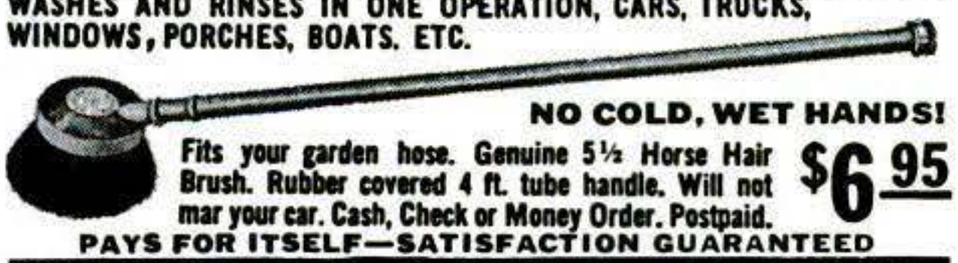

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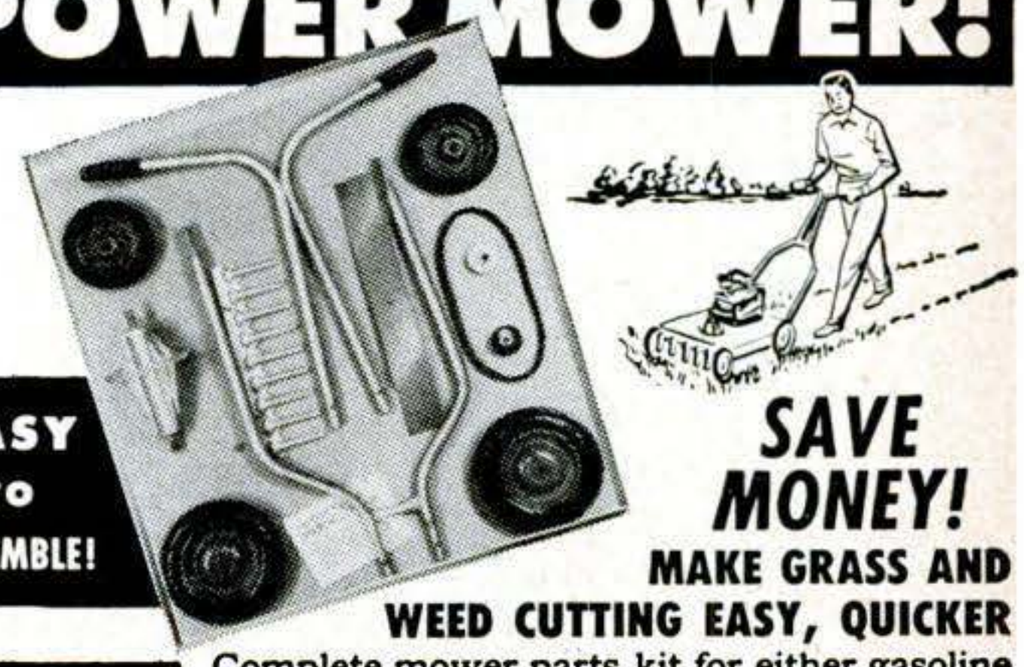

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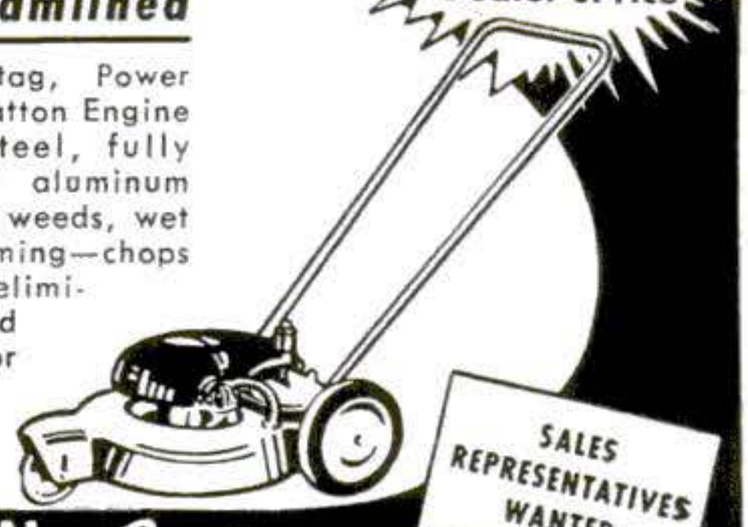

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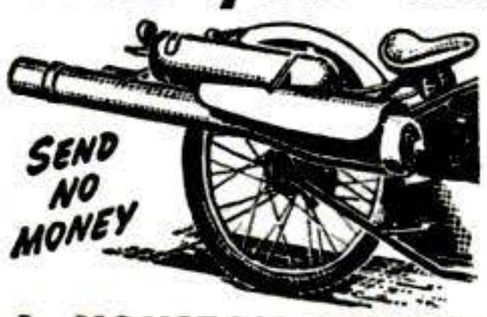

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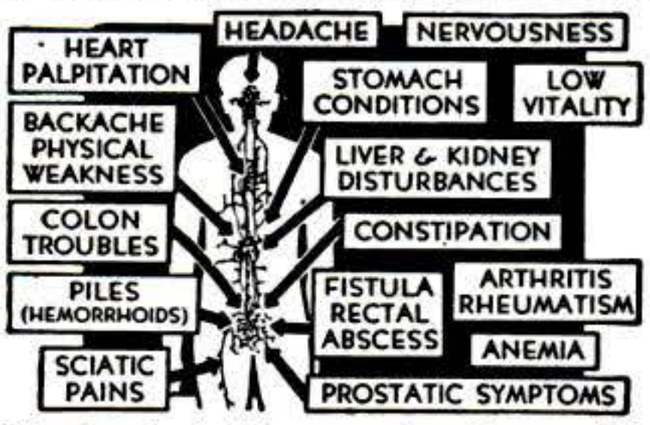

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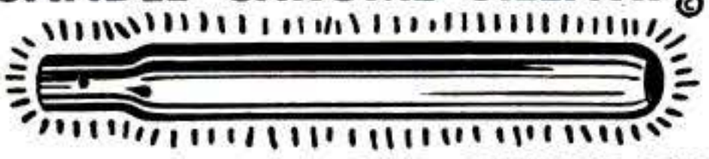

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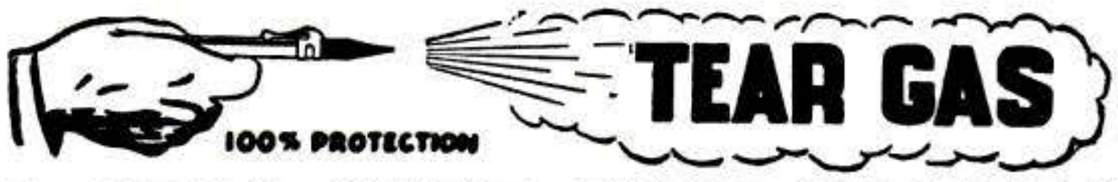

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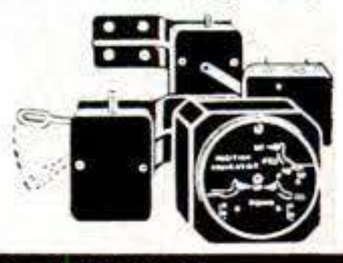

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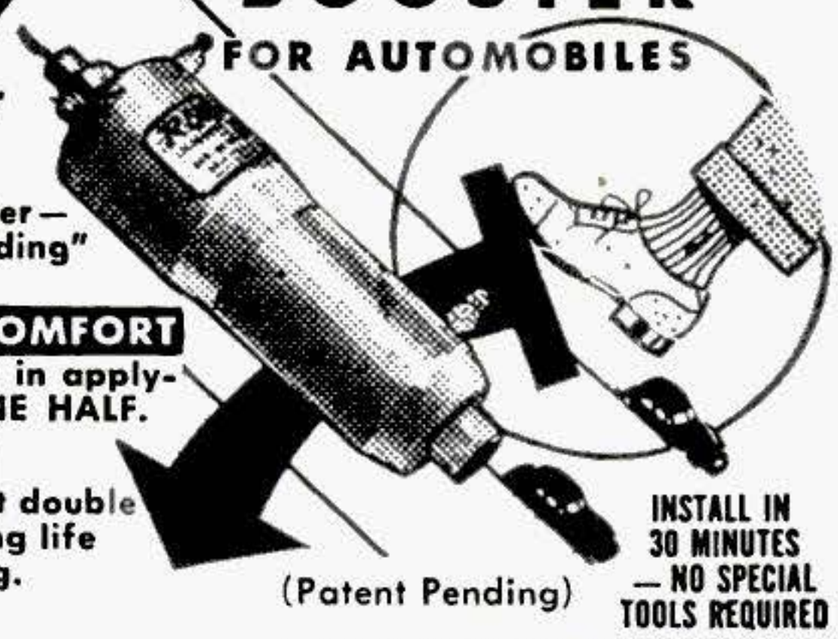

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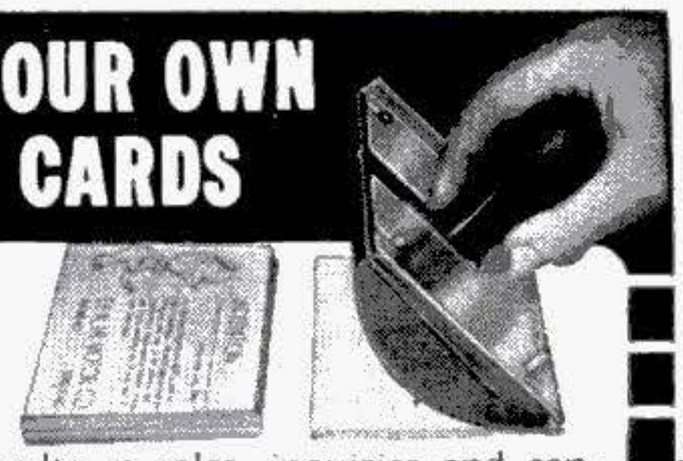

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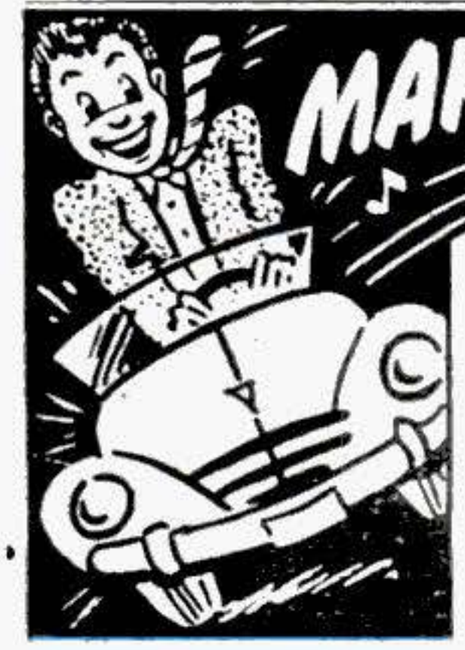

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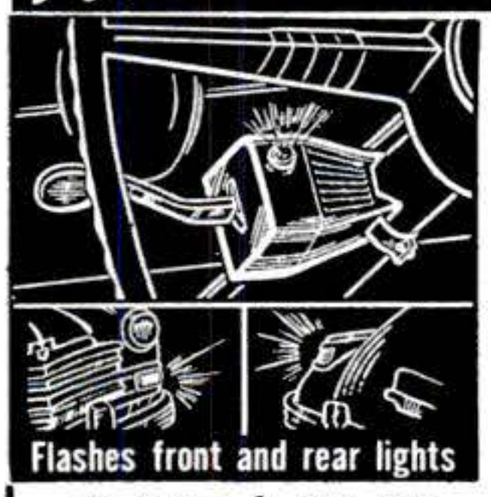

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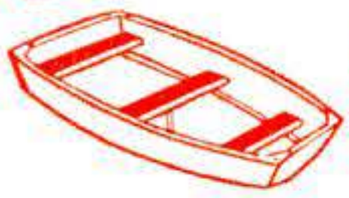

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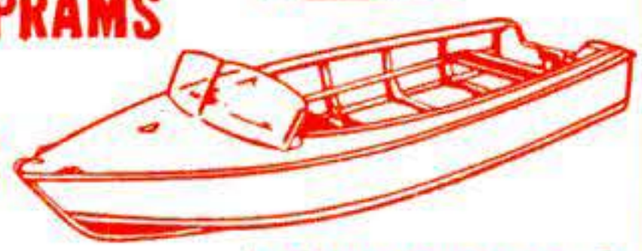

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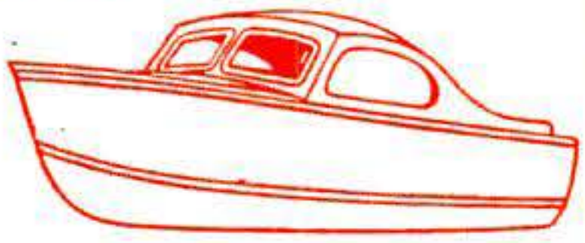

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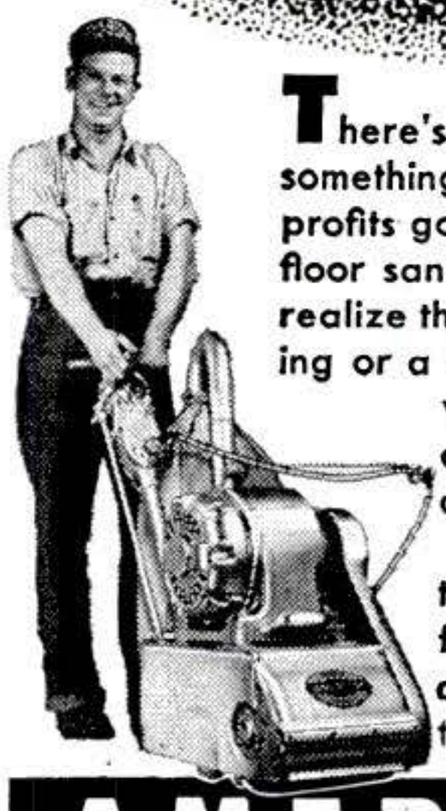

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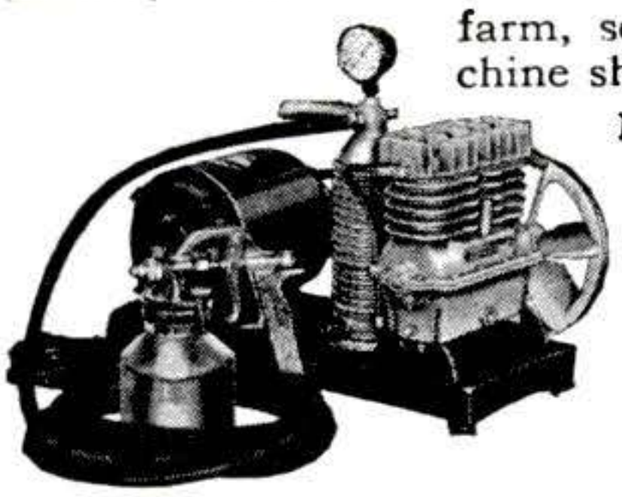

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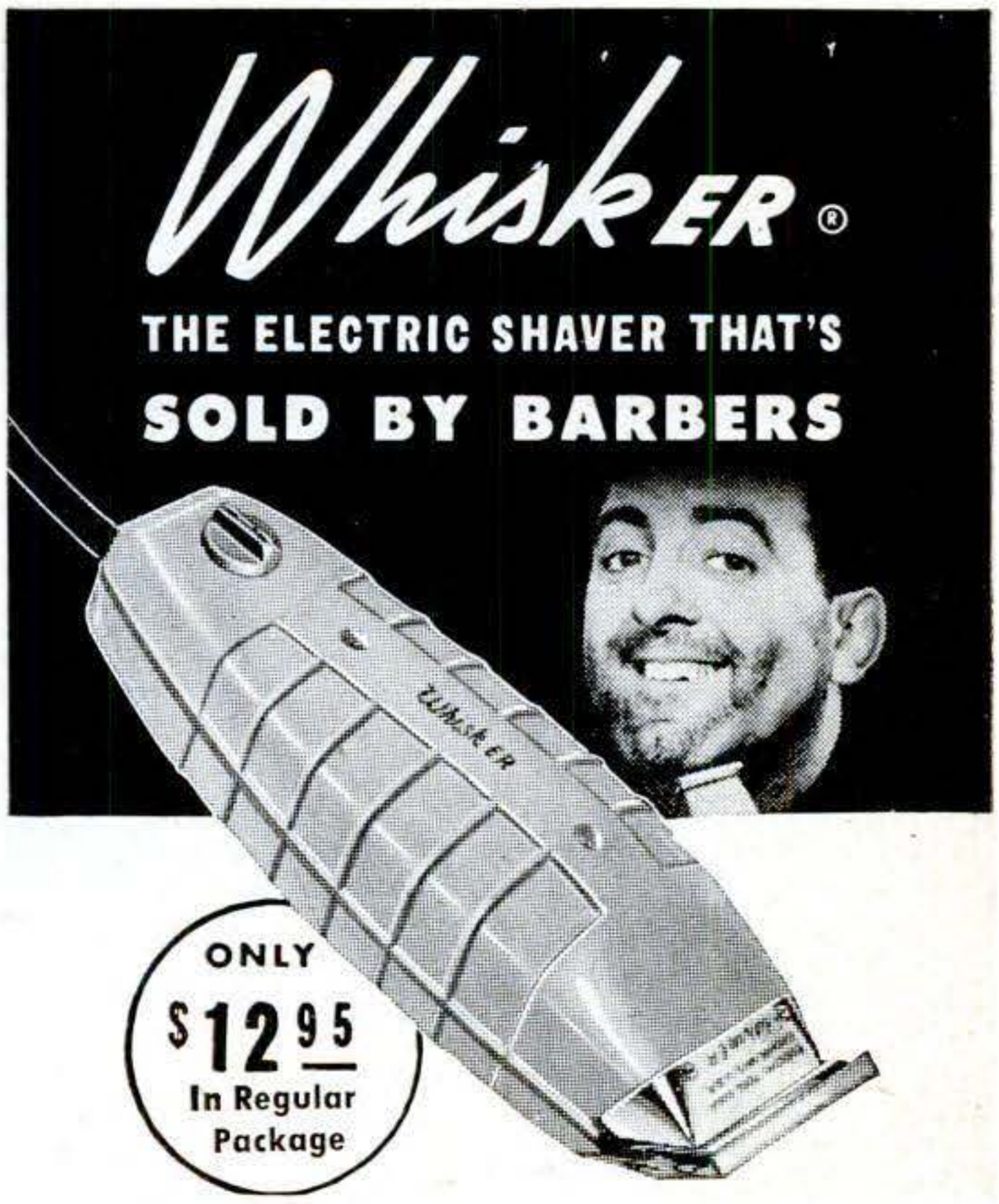

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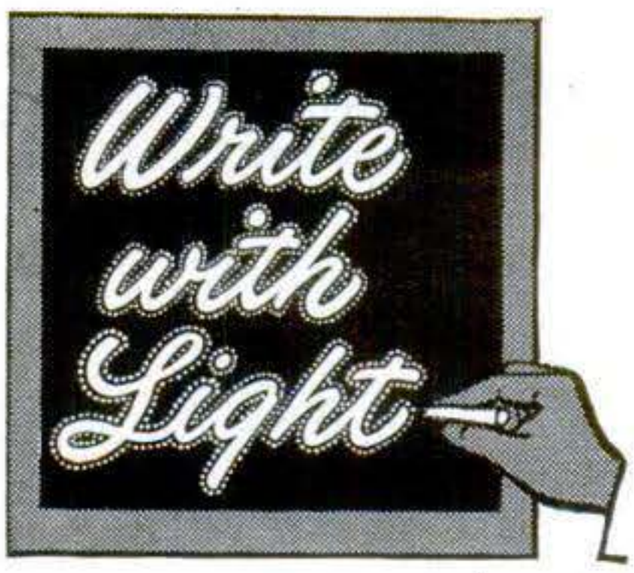

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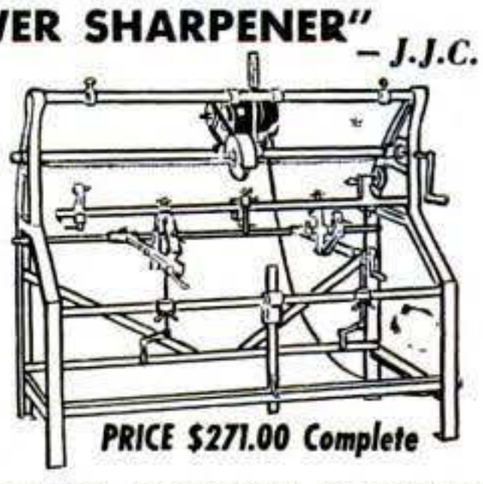
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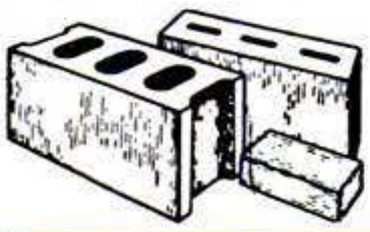

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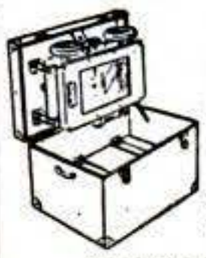

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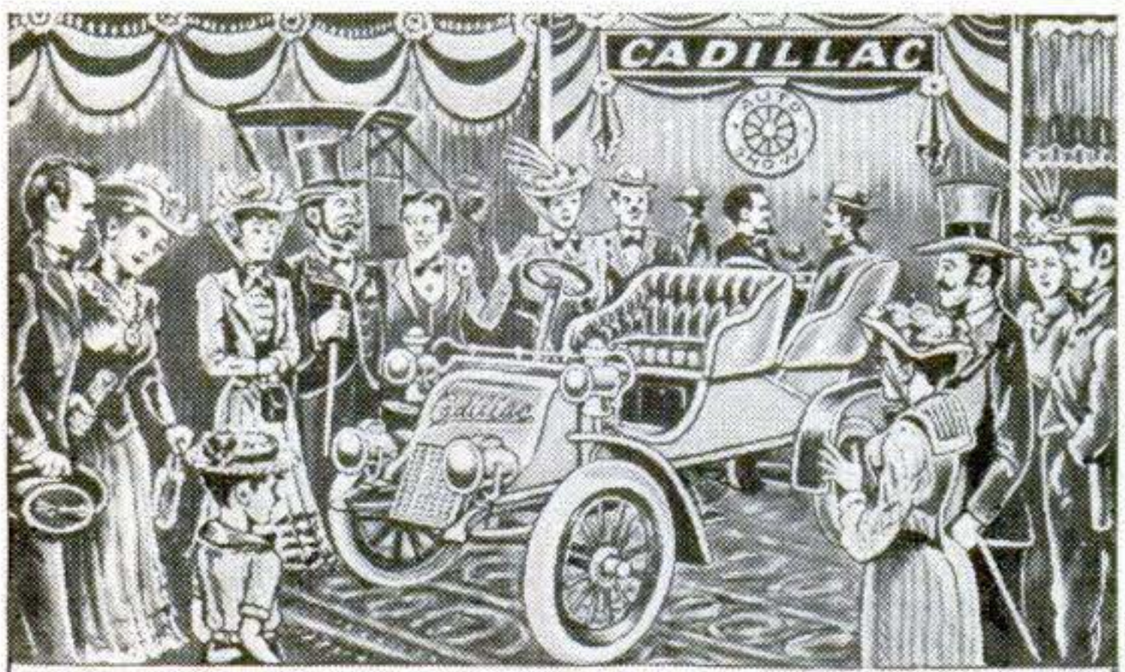

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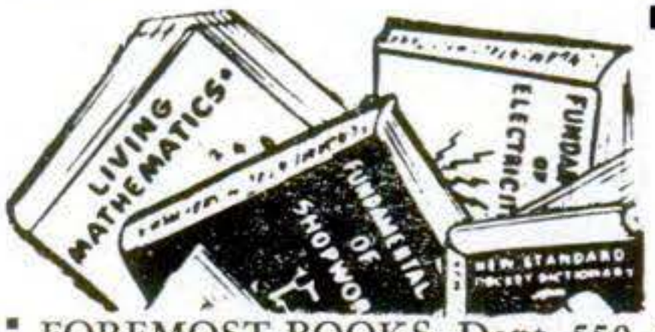

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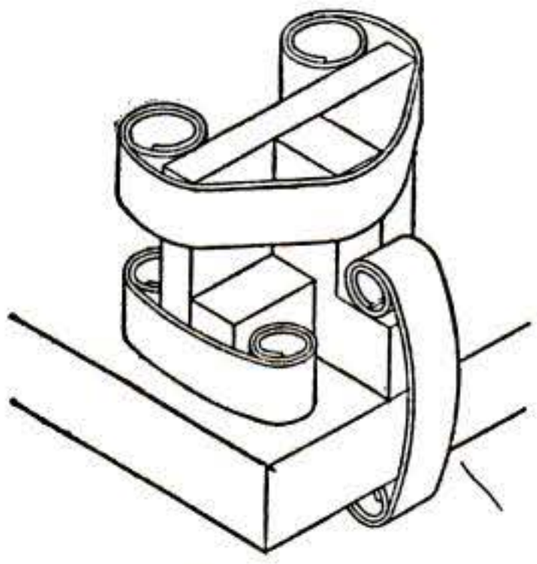

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101 IDEAS FOR A HOME BUSINESS OF YOUR OWN. New fact packed book of opportunities for YOU. Real moneymakers. 25c postpaid. Hurry! Malcy, 3833-A Southport, Chicago 13, Illinois.

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57 MONEY MAKING OPPORTUNITIES

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SELL $2 Fire Extinguishers. Locally mailorder. Lorrac Products. Albany 1. N. Y.

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SELL Swiss wrist watches 14K gold-plated case-band unit; rhinestone dial. Sensational $15 retailer. Send for information & sample $6 C.O.D. Money back guarantee. Dept. P5. Dunhall Imports. 101 Cedar St.. New York City.

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63 HIGHGRADE SALESMEN

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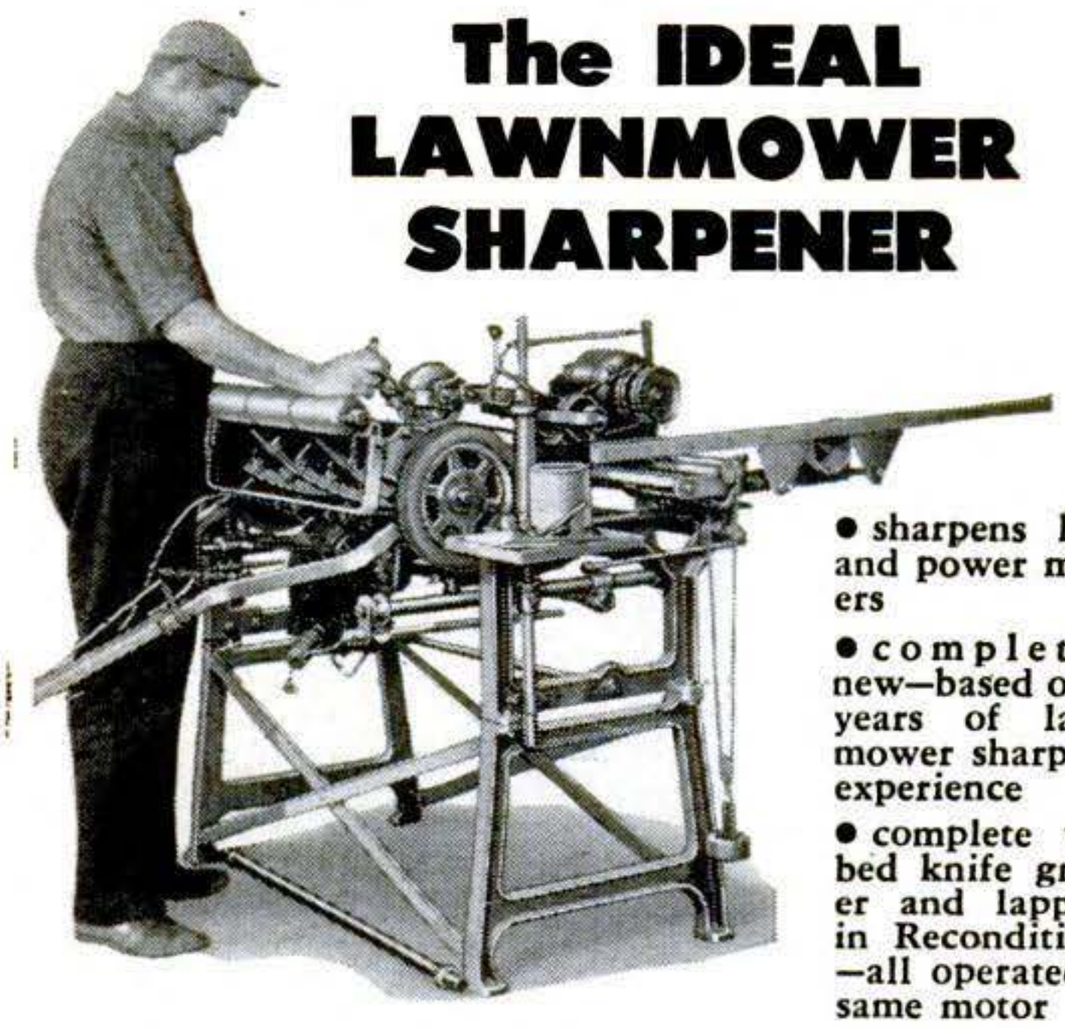

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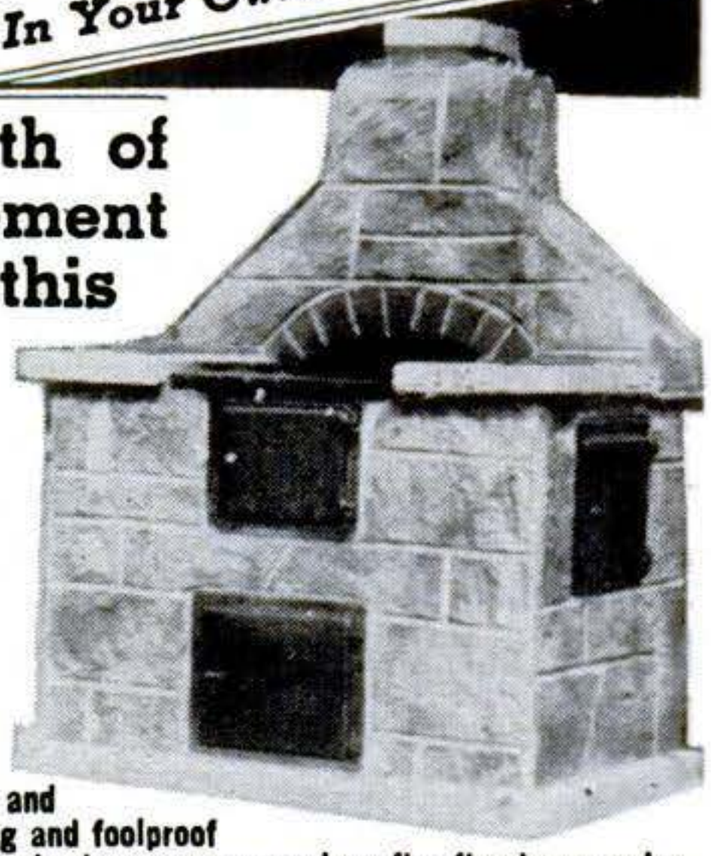

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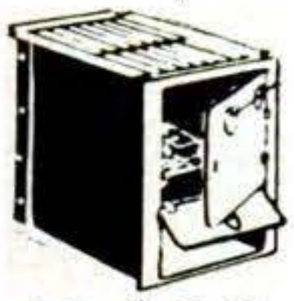

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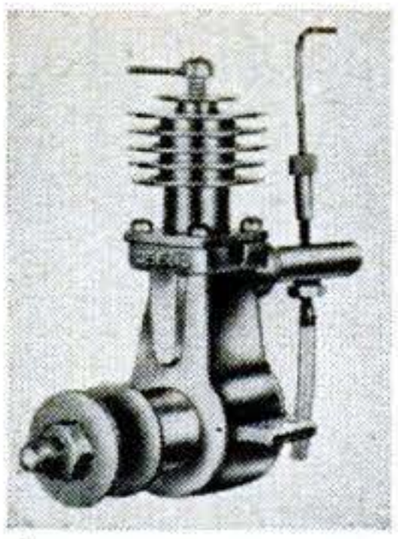

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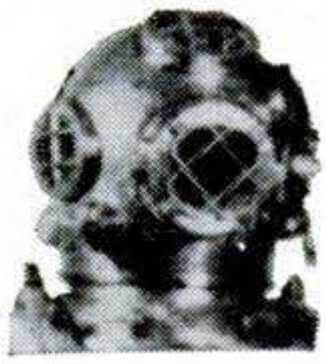

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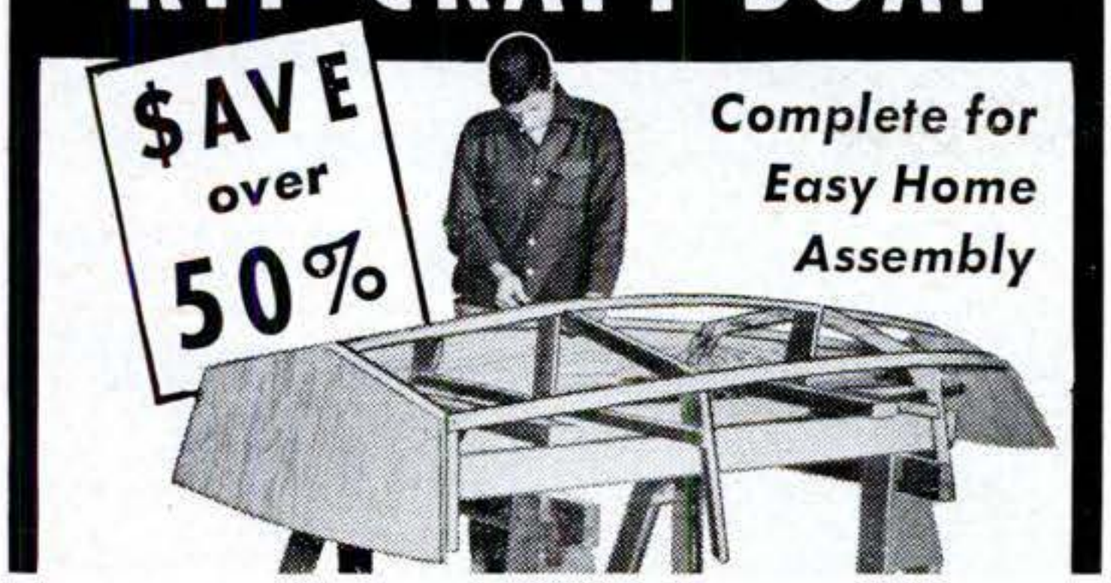

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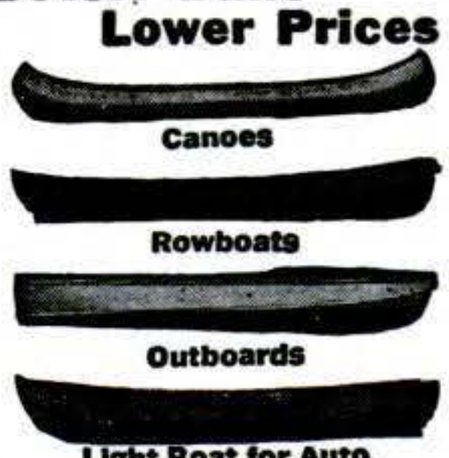

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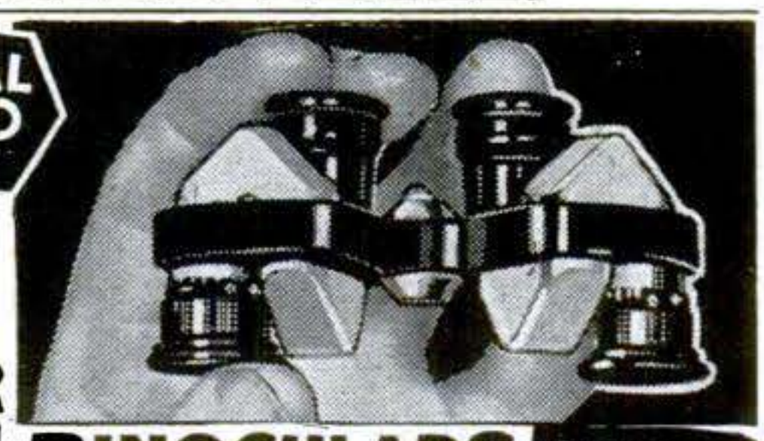

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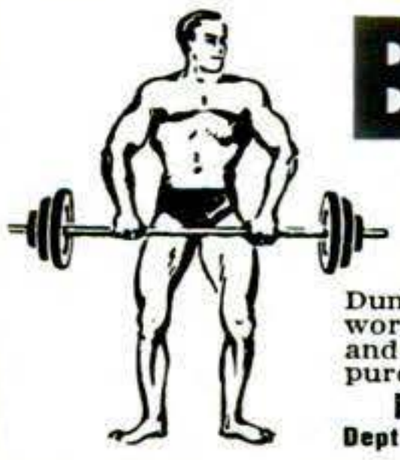

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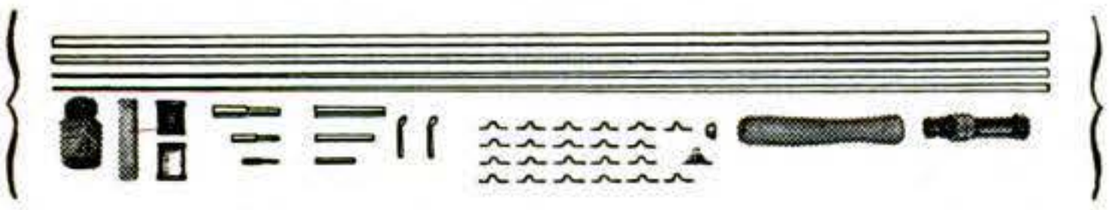

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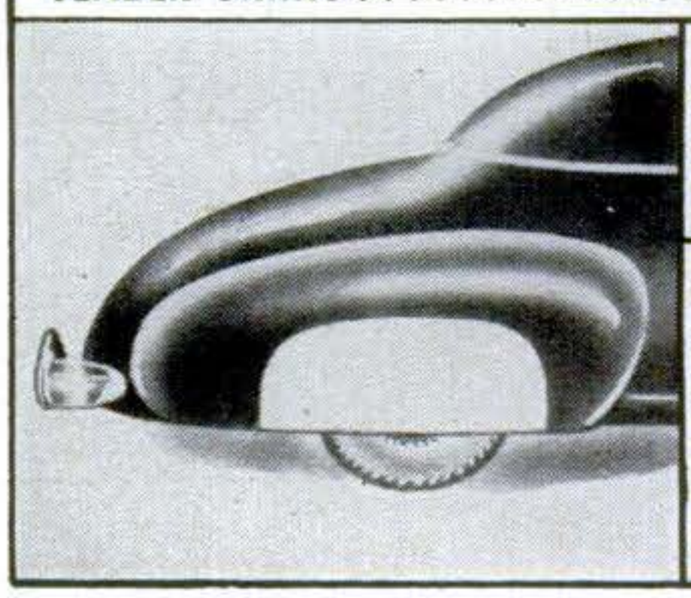

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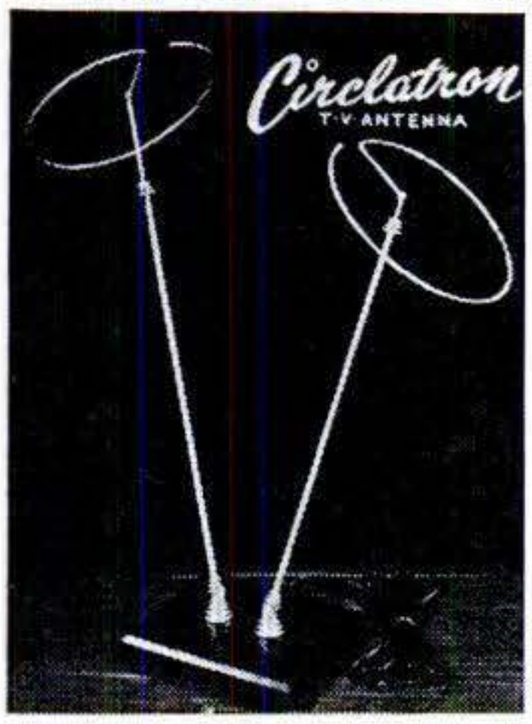

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- Attach to present antenna terminals.

*See picture and item on Circlatron in March, 1950 issue of Popular Science on page 256.

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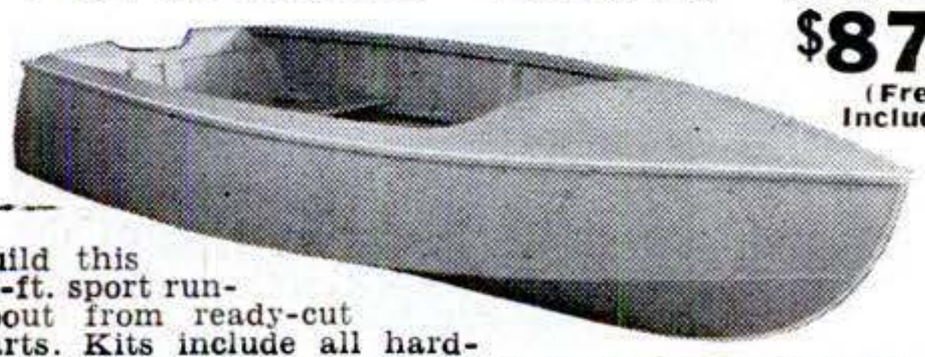
$87.50 (Freight Included)



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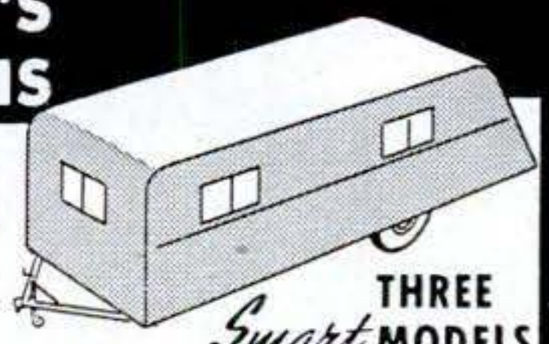

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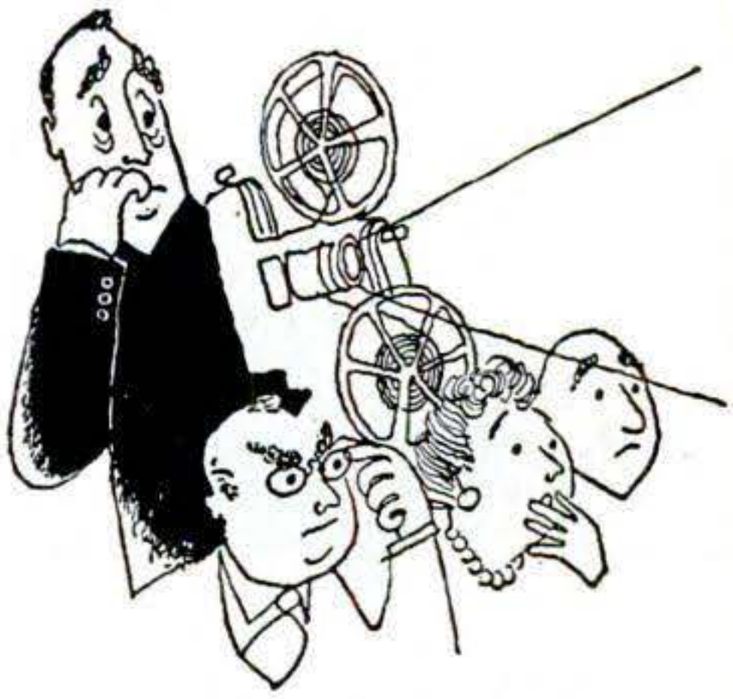

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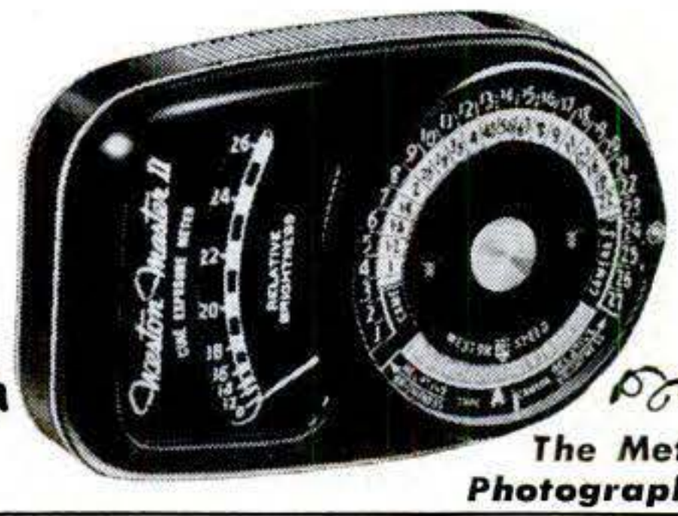

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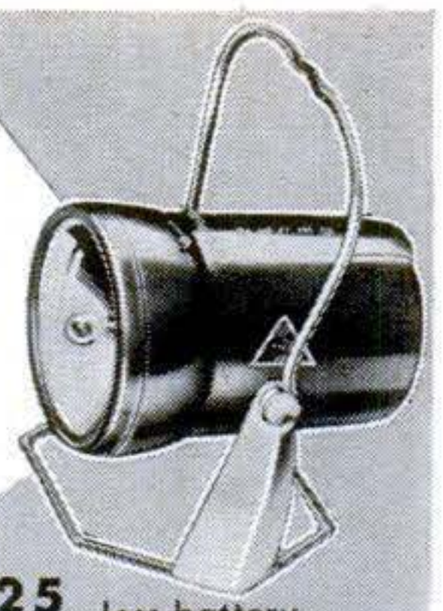

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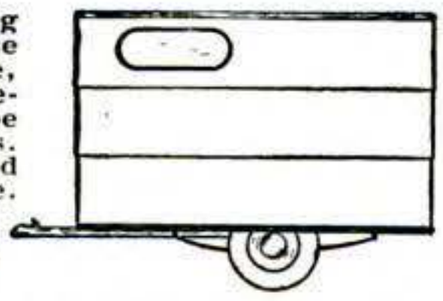

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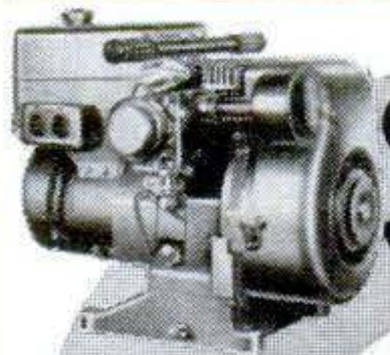

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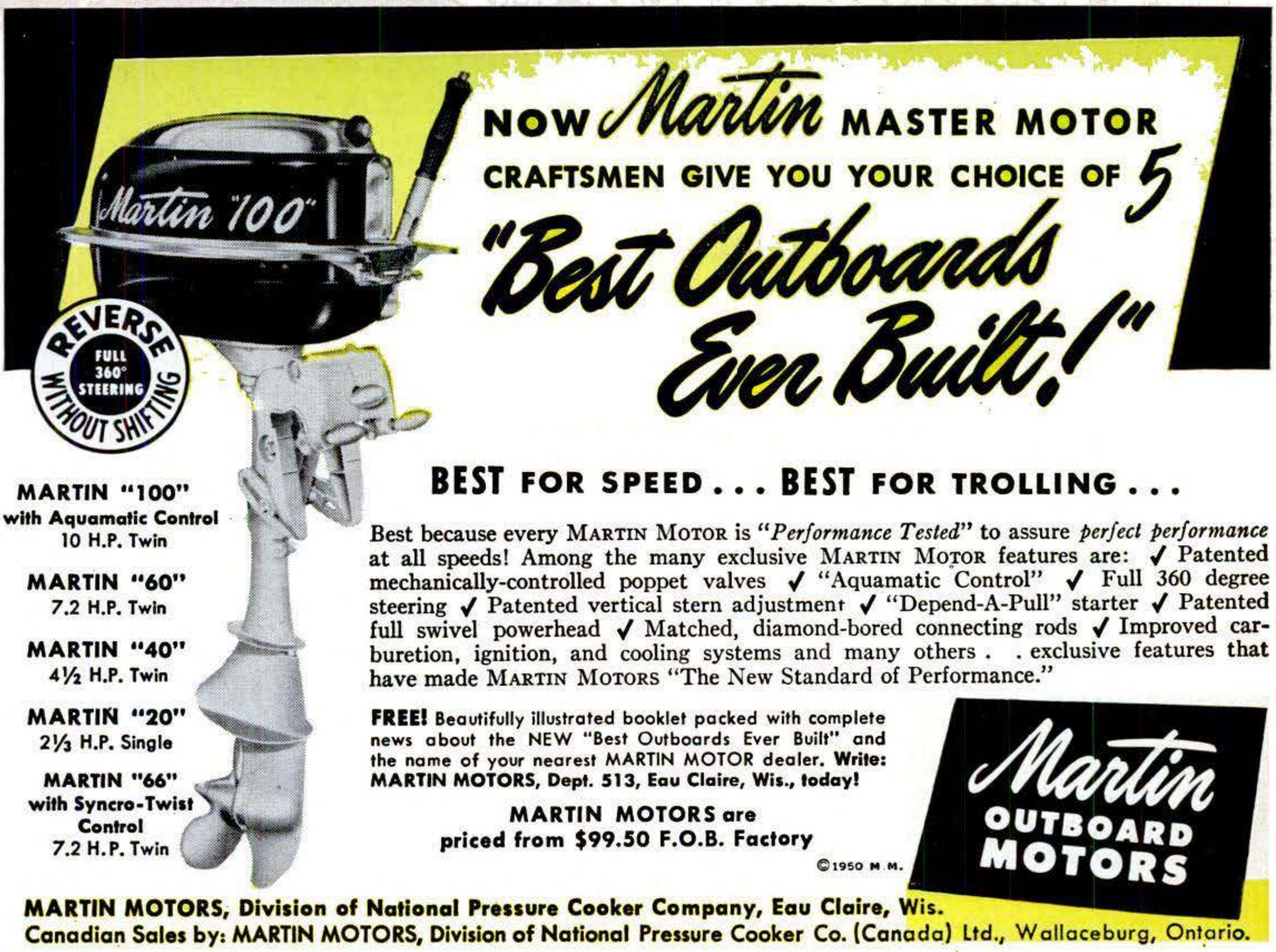

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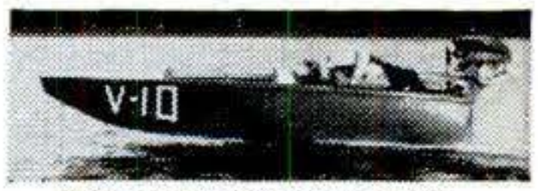

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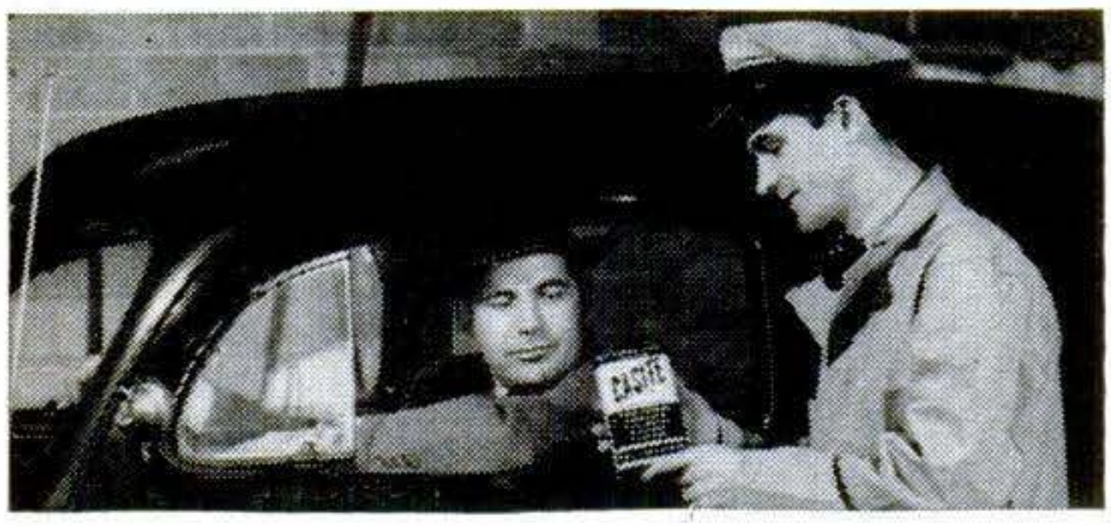

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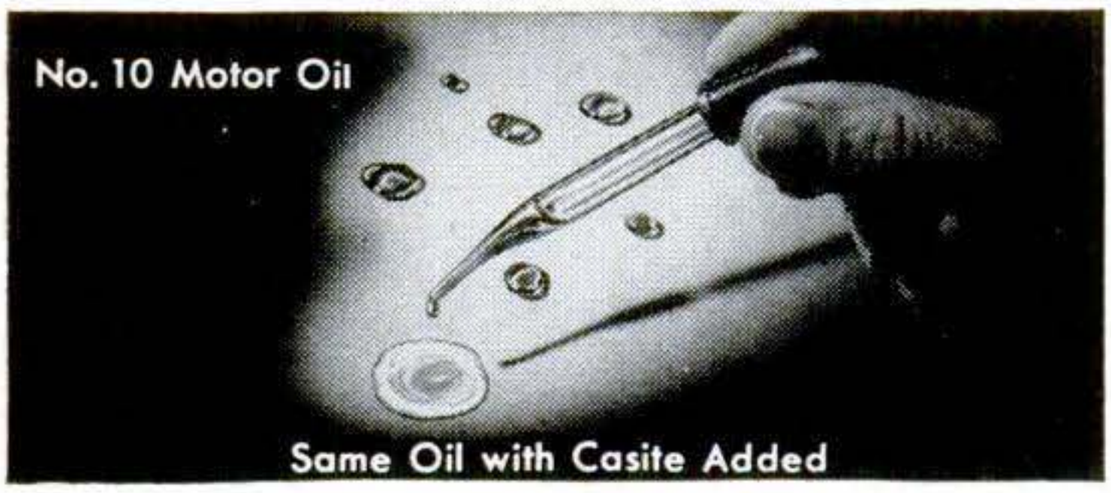

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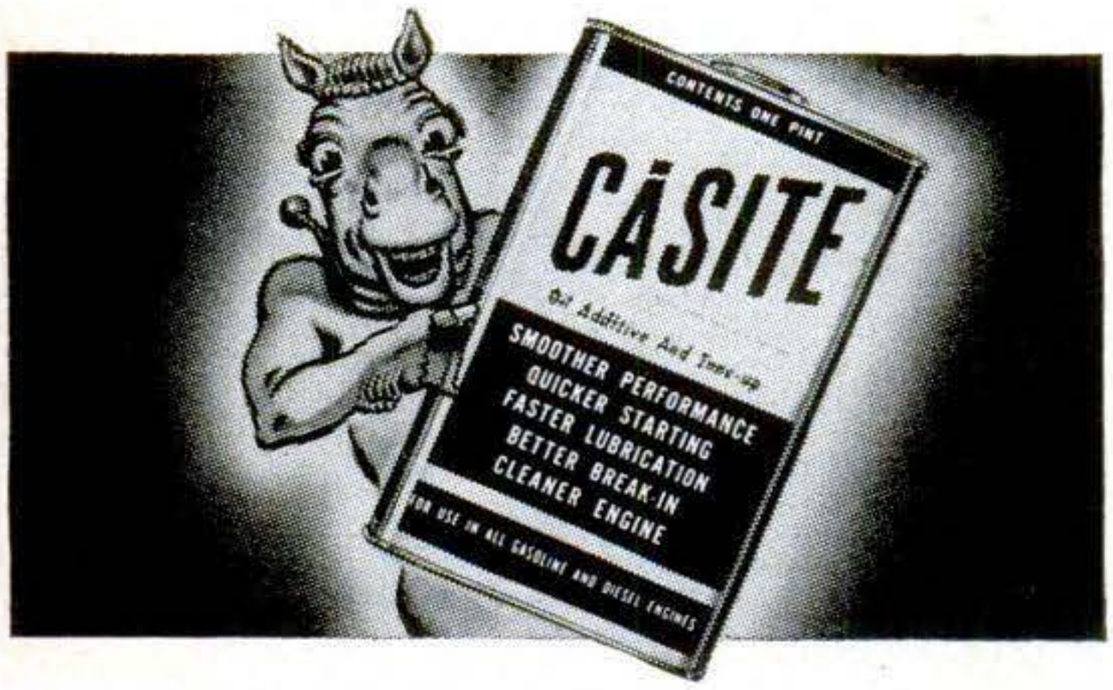

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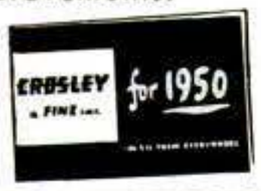

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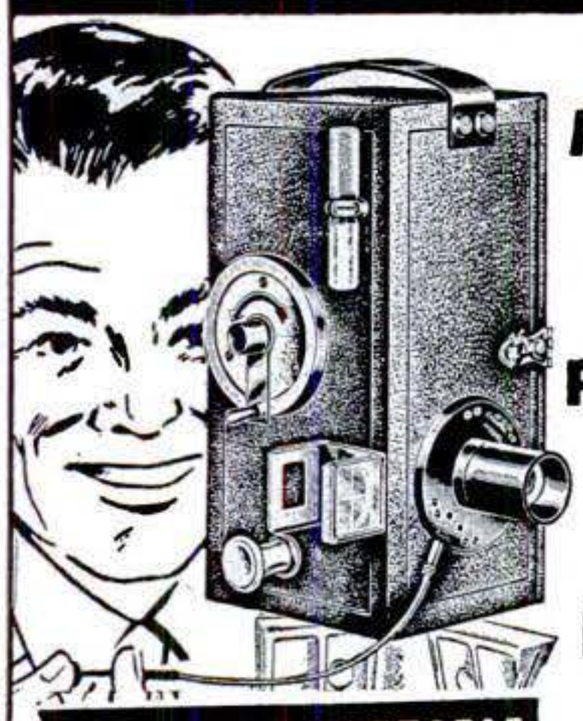

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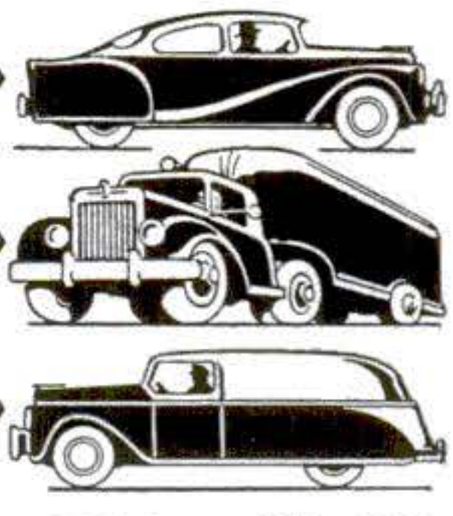

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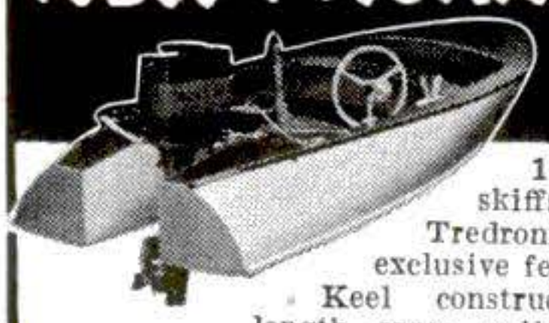

17 New models. Improved design, skiffs, outboards, inboards, sail boats. Tredronic racers, cruisers. 8 to 16 ft., exclusive features. Preassembled frames, Tri-Keel construction, Tredronic bottom, full length spray rails, widest beam, simplified construction, easy to build. World's best boat buy! Send 25¢ for new 1950 literature, or send $1.00 for literature, plus booklet "Plywood Boats."

BOAT PATTERNS-BLUE PRINTS

1950 Catalog—over 100 modern designs by famous naval architects. Racing classes, cruisers, inboard, outboard, sail. 6 to 35 ft. Plywood—Steel—Plank. Construction plans, full-size patterns. Send 35¢ for catalog or $1.00 for catalog and helpful booklet on "Boat Building."

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HARLEY-DAVIDSON

HYDRA-GLIDE

THE lure of motorcycling is like nothing else in this world! Once it's in your blood . . . brother, you'll never be the same again! From then on, nothing can ever equal the fascination of cruising down a scenic country road with a Harley-Davidson purring quietly under you . . . the he-man thrill of soaring up a steep hill like a climbing jet . . . the breathless feeling of levelling off for the straight-aways . . . the sense of power and freedom you get whenever you settle back in the saddle and "give 'er the gun!" In no other sport are friends so loyal, gals so glamorous. Nowhere is fun so easy to find as at exciting race meets, hillclimbs, gypsy tours and other club events. A Harley-Davidson is your ticket to endless good times, to happy, healthful outdoor enjoyment. You can own one on easy terms. So why not get started now? See your dealer today.

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New-type glass for RCA television picture tubes filters unwanted light, to give sharper, clearer images.

Wayward light is disciplined—**for better television!**

Now television pictures gain still greater contrast and definition—through research originally initiated by scientists at RCA Laboratories.

Their discovery: That wandering light waves inside a picture tube—and inside the glass itself—may cause halation and blur an image's edges. By introducing light-absorbing materials into the glass, the wayward flashes are absorbed so that only the light waves which actually make pictures can reach your eyes!

Glass companies, following this research, developed a new type of glass for RCA . . . *Filterglass.* Minute amounts of chemicals give it, when the picture tube is inactive, a neutral tone. In action, images are sharper—with more brilliant contrast between light and dark areas. Reflected room light is also reduced.

* * *

See the latest in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, N. Y.

The new Filterglass faceplate gives you more brilliant pictures on today's RCA Victor television receivers.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

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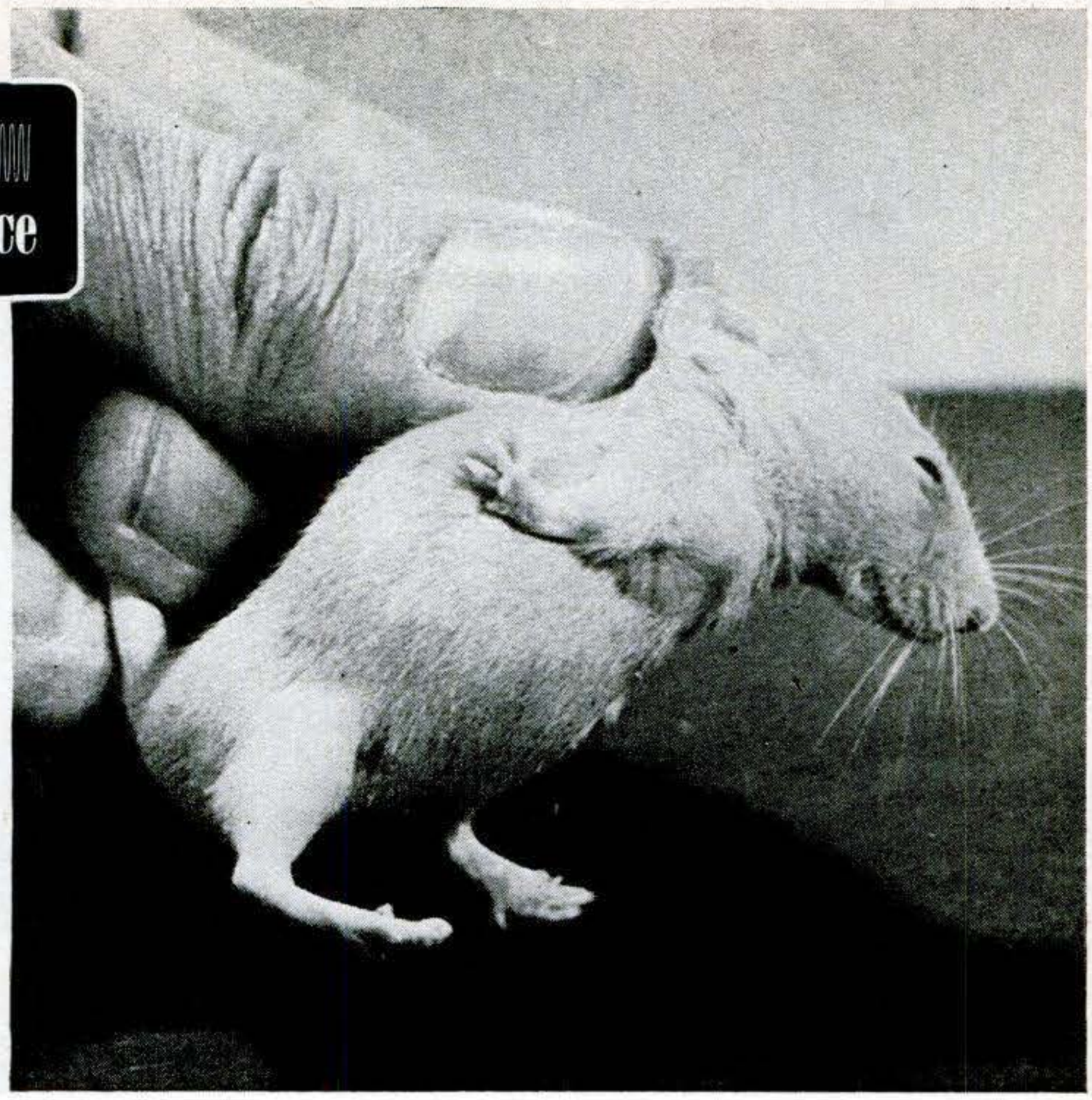
PS
The Voice of Science

No Way To Run



THE useless foot of this mouse illustrates a mutation. The chances that a mouse or a man will be born with a defect such as this are normally very small. Deleterious mutations may occur more often, however, if war is waged with atomic weapons.

This mouse is one of 40,000 mice behind the fences at Oak Ridge, Tenn. The family trees of these mice may enable the scientists to guess better than they can now what will happen to human beings many years from now if a great many people are exposed to the radiation from A-bombs and H-bombs.

Some of the Oak Ridge mice have been given measured doses of radiation similar to that which is emitted when atoms are split or fused. Then these mice have been permitted to breed. Now, their keepers are watching for mutations—such as defective feet, tails, and heads—among the infants born in this well-guarded colony.

This experiment at Oak Ridge is believed to be the only large one of its kind now under way. It was undertaken because scientists disagree about how seriously exposure to radiation can affect the survivors' descendants. They know that nuclear radiation increases the frequency of mutations in fruit flies. They know, too, that radiation affects all living things similarly. But they are far from certain how seriously radiation can harm mankind.

Centuries will pass before all of the results of the bombing of Hiroshima and Nagasaki become apparent. But mice resemble men in many ways and produce four or five generations a year—so the records of the Oak Ridge mice may enable the scientists to guess better than they can now how horrible a price our grandchildren's children might have to pay for an atomic war.

The necessity for this experiment with mice indicates that biology now lags too far behind physics as a science. The biologists will not know for some time how serious the consequences of using A-bombs may be, but the physicists already have started work on H-bombs.

Shouldn't something be done about this? Can't more ways be found to learn more about living things quickly? Shouldn't as much effort, manpower, and money be devoted to biological and medical research as is being spent to make weapons more powerful?

Volta Torrey

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Puts *Wings* on your boat!

NEW KIEKHAEFER MERCURY "Super 10" HURRICANE

Never before such pep, power, and all around performance in a light outboard.

Crack the throttle and sample the thrill of commanding a "Hurricane!" Pour on the coal. Mercurys are built to take it. This 1950 package of power was built to outrun—built to outlast. It packs ready, confident Full Jeweled Power* to command any kind of outboarding—fishing, water skiing or just zooming along.

*Ball and Roller Bearing Construction Throughout for Easier Starts, More Performance Per Horsepower, Greater Operating Efficiency, Slower Trolling, Longer Trouble-Free Life.

IT'S *LOADED* WITH NEW FEATURES:

NEW "HI-REV" micro-mounted connecting rods of drop forged chrome nickel-moly steel, heat treated, hardened, tempered, precision ground and micro-honed to just the right scientific finish.

NEW Improved Porting to permit easier flow of fuel and gases.

NEW Drop Forged Unbreakable Aluminum Clamp and Swivel Brackets, heat treated to the strength of steel.

NEW High RPM Magneto — **NEW** 8 Reed Valve Cage — **NEW** Larger Crankcase Opening. And many other New Features that add up to new thrills in outboarding.

Drive it! Only a demonstration will prove why the Hurricane—or any MERCURY, Right Down the Line — is your best buy, by far!

KIEKHAEFER CORPORATION, Fond du Lac, Wis.

Write for Free Folder *"Right Down the Line"*

Features of Mercury outboard motors are protected by issued or pending patents.

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POPULAR SCIENCE
REG. U. S. PAT. OFF. *Monthly*

TV Puts on Cap & Gown . . . This picture previews a new job for television—teaching school. It shows how an instructor in watch-making could deliver an illustrated lecture in a new kind of classroom made possible by a new cheap, portable TV camera. On the big viewing screen in the foreground is a close-up of the works of an actively ticking watch. The image is so large that a whole class can see the adjustments being made by the teacher. Even he is working by television, keeping his eyes on the small monitor screen at his right. Only the camera, directly in front of him, need look down at the actual watch. The camera is RCA's new Vidicon®, a lightweight TV unit that promises widespread industrial and educational use of television. For details on this important development, turn to page 119.

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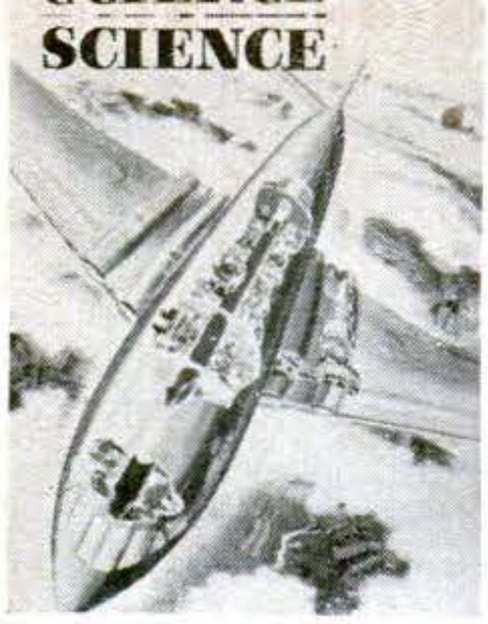


Cover by Jo Kotula

"I Saw This Jet

Devon Francis reports from England, "The Comet roars like a dozen trains, but lands easy as a DC-3 . . . It cruises at 40,000 feet . . . devours 1,300 gallons of fuel an hour."

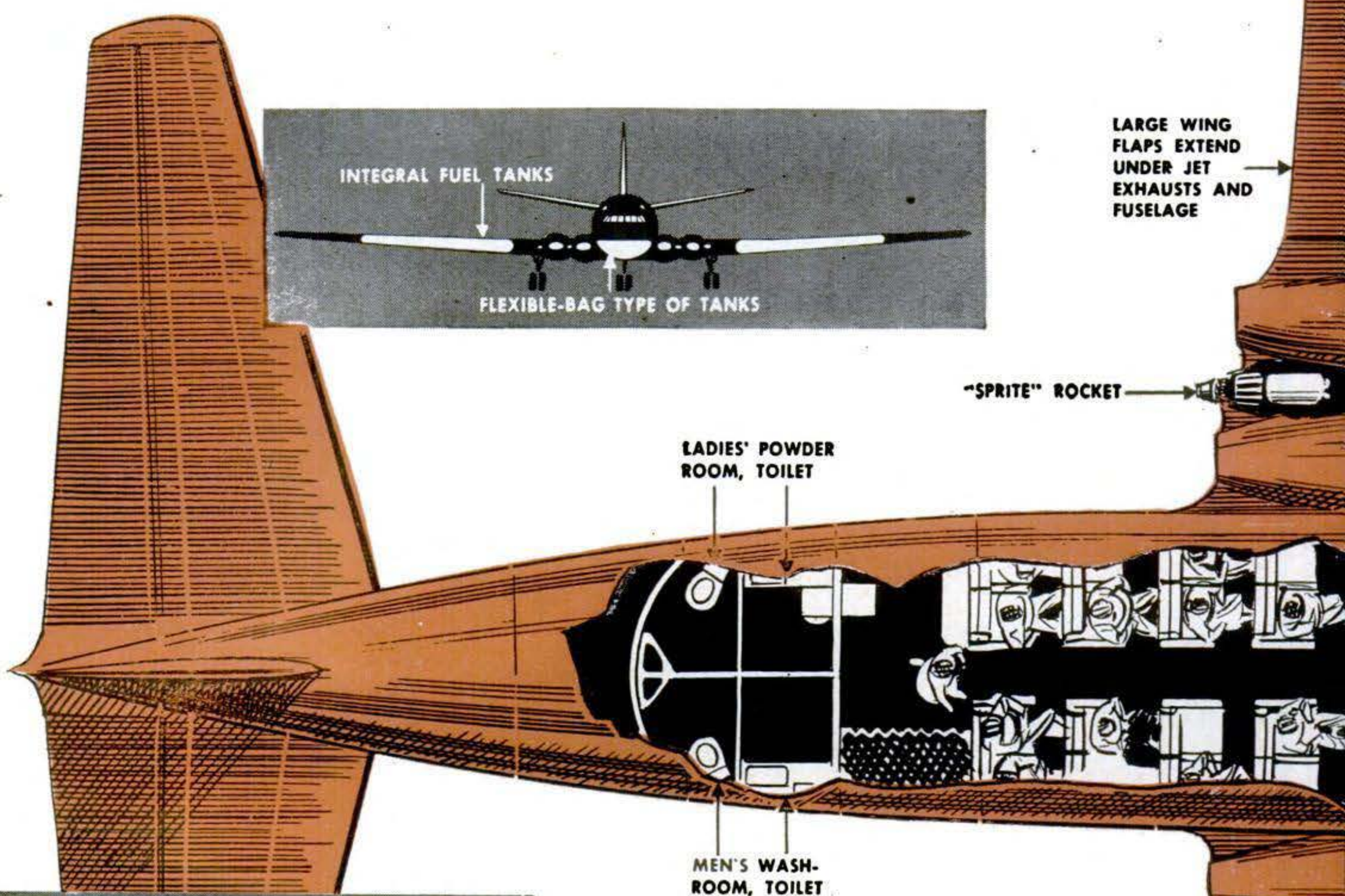
HATFIELD, ENGLAND

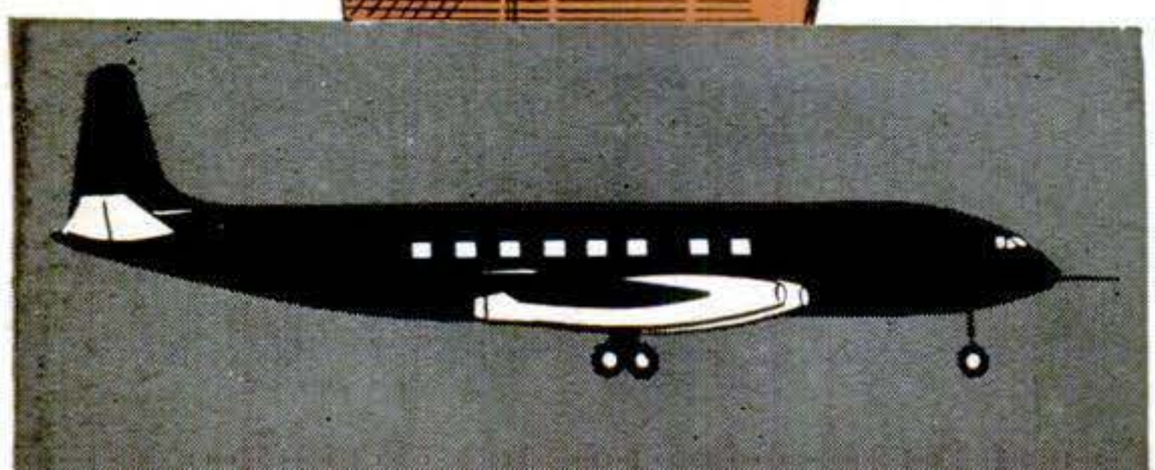
THE 50-ton air liner squatting on the hangar's apron taxied to the down-wind end of the runway, its gas turbines whining at low speed. Then, as the throttles were pushed open and the plane began to gather momentum, the jets' roar rose until it sounded like a dozen railroad trains.

I was watching the conclusion of de Havilland's long period of tests on the four-jet, 8-mile-a-minute Comet—the passenger plane that leaves America's proudest air liners lumbering far behind.

An hour later, this jet-propelled monster that cruises 8 miles above the earth at 500 miles an hour drifted down to as casual a landing as any propeller-driven transport could make. Only a small group of spectators greeted it.

"You don't see any mechanics rushing out with wrenches and screwdrivers, do you?" a de Havilland man asked me. "They did in the beginning. We all thought trouble must have developed in flight. It always does with new airplanes. But this one has given us not one bit of mechanical trouble since its first take-off."





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Liner Fly 500 M.P.H."

This is the plane that will pick you up in London at noon on the Greenwich clock and put you down in New York in time for cocktails, or fly you from Los Angeles to New York between lunch and dinnertime.

Author Francis (right), Comet base, Hatfield.

Cutaway of Comet shows provision for extra-large kerosene tanks, holding 7,200 gallons, to fuel voracious jet engines. Plane's over-all length is 93 ft.; height, 28 ft., 4½ in.; and wing span, 115 ft. Chord of big-but-thin wing, swept back 20 degrees on leading edge, is 29½ ft. at root and only 6 ft. 9 in. at tip. It has an area of 2,015 sq. ft. Water tank holding 20 gals. for passenger use is in roof adjacent to galley. For emergency landings, plane will carry two 15-seat dinghies, radio, and rations. Auxiliary system will supply oxygen for descents in case pressurization fails.

WING SLATS

COMET'S GREAT WING AREA GIVES PLANE LIGHT WING LOADING OF ABOUT 50 POUNDS PER SQUARE FOOT AS COMPARED WITH 80 POUNDS FOR LATEST U. S. AIR LINERS.

FUEL TANKS

4-WHEEL MAIN LANDING GEAR

NAVIGATOR

CAPTAIN

CO-PILOT

RADAR OFFICER

Drawing by Jo Kotula

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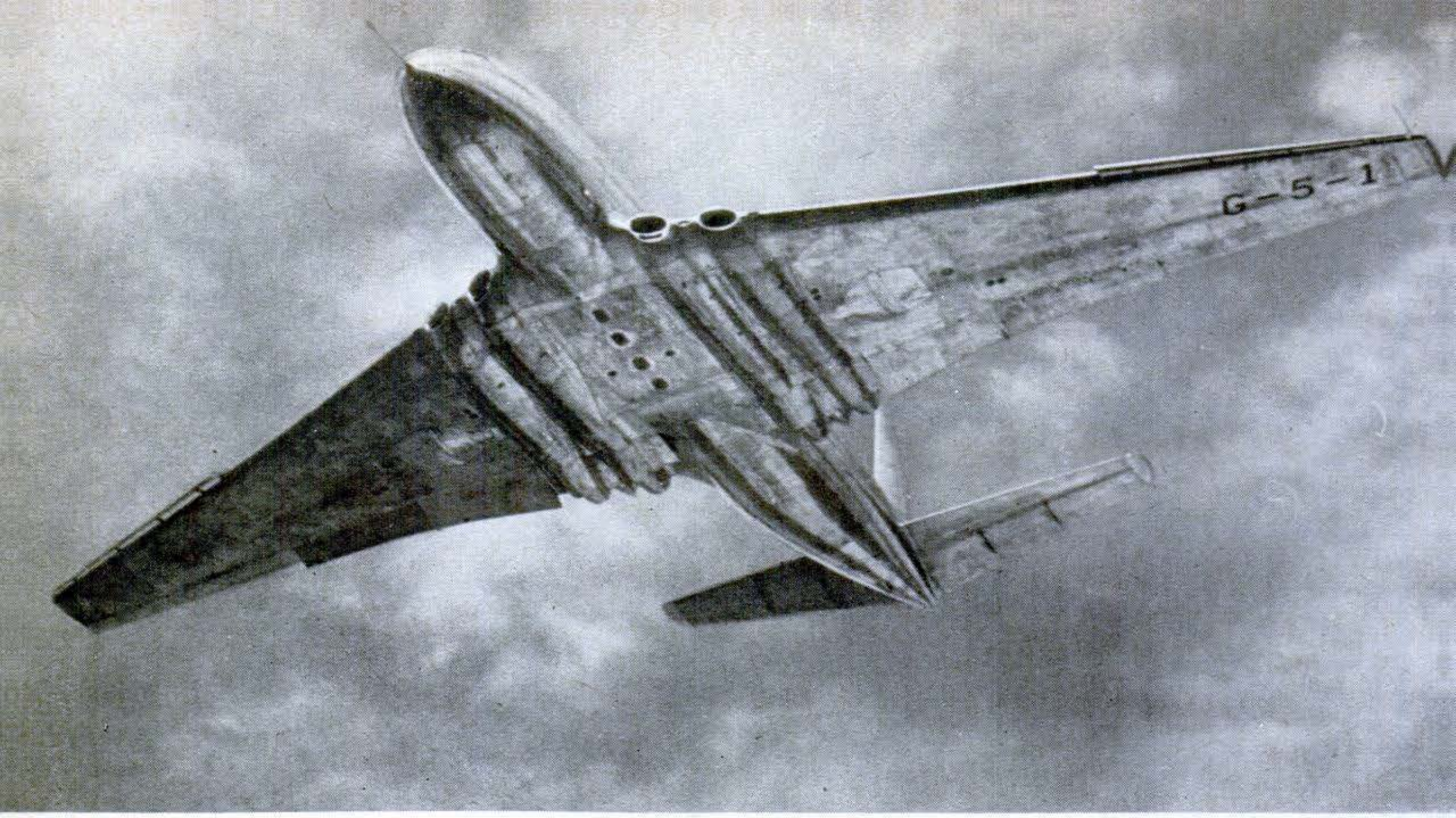


With slots, near wingtips, open, and flaps partly extended, Comet takes off on a test flight.

It is the fastest thing ever built for regular commercial air-line service.

Here at Hatfield, they're building a covey of Comets now for shakedown and indoctrination flights next year. In 1952 British Overseas Airways will have them on its Empire routes. Jet trans-Atlantic flights probably will not start until 1953. But the big jets will be flying over blue water to Asia from Vancouver before then. Canadian Pacific Air Lines expects to jet to Hong Kong, 6,800 miles away, in 20 hours, even with stops in Alaska, the Aleutians, and Tokyo.

How They'll Fly

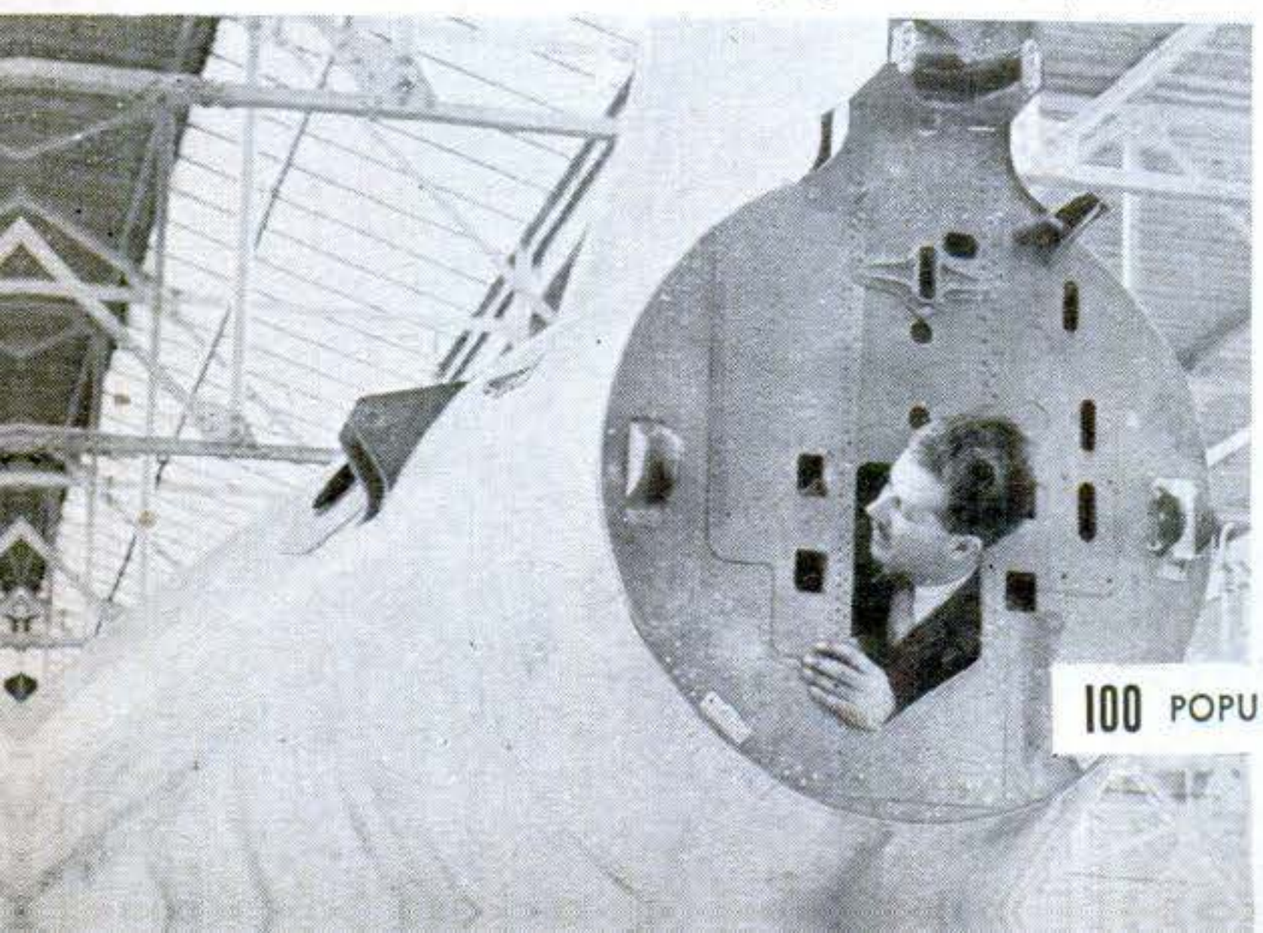
The jet air liners will fly at 40,000 feet, which is twice as high as conventional, pressurized air liners now fly. The clouds will all be below you. There'll be so little vibration that you'll be able to stand a pencil on end anywhere in the ship, and no noise.

Quiet as a Comet

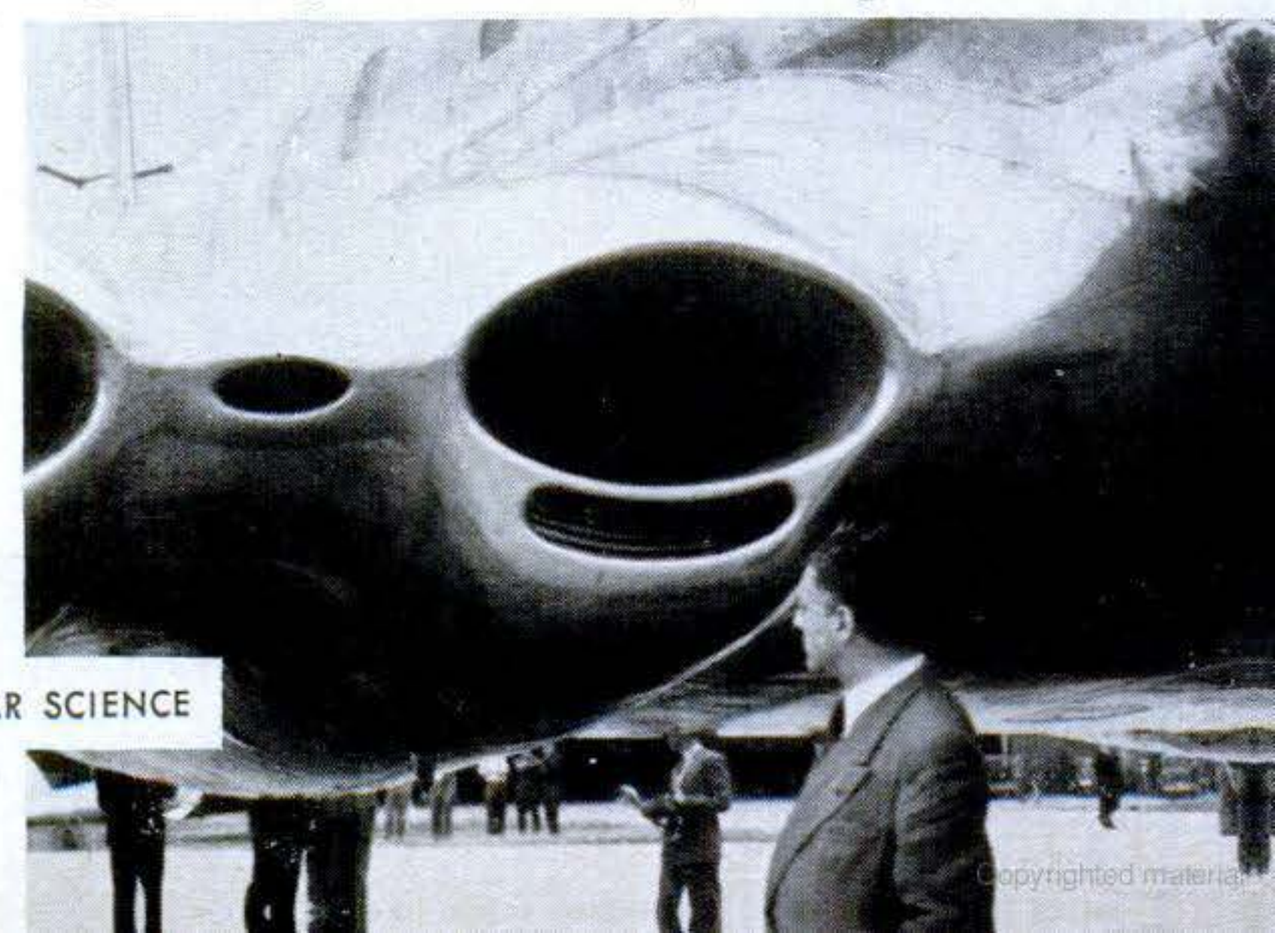
It's so quiet aboard the Comet that pilots fresh from piston-engine planes often forget to pull the engines back to cruise revolutions after take-off. Even blond and handsome John Cunningham, the pilot who has done practically all the testing of the Comet, finds the silence incredible.

Once he heard an unearthly rumble as he flew over the big company airport. Reacting instantly, his glance swept over his turbine instruments, looking for trouble. But all was in order. Then, as suddenly as it had started, the noise stopped. Only then did Cunningham realize that he had passed over some gas-turbine test stands on the

Technician at Hatfield factory thrusts head through aperture in last bulkhead, under fin. His legs protrude through access door in skin. Estimated Comet delivery price is $1,260,000.



Elliptical air intakes for engines are flush with wing's leading edge. Hole below inboard intake is for cabin air conditioning. Smaller holes in edge of wing are for auxiliary cooling.



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ENGINE AND LANDING-GEAR WARNING LIGHTS

SIDE PANELS CARRY CONTROLS AND INSTRUMENTS FOR ELECTRICAL SYSTEM, FUEL FLOW, CABIN PRESSURE

ENGINE PANEL

CAPTAIN'S FLIGHT PANEL

FIRST OFFICER'S FLIGHT PANEL

THROTTLES

FUEL VALVES

Gone from the Comet's cockpit are many of the instruments familiar in prop-driven planes.

ground below, and that the noise he had heard had come from them.

The four de Havilland "Ghost" gas-turbine engines in the Comet develop a maximum total thrust of 20,000 pounds. That much thrust about equals 20,000 horsepower at a speed of 375 miles an hour. The most powerful air liners now in service use four piston engines with a total of only 14,000 horsepower for take-off.

Traces of Birds

Turning the compressors at the front of the Ghost turbines absorbs 48,000 horsepower—and that is approximately the total horsepower of the old 45,000-ton *Aquitania,* now being scrapped on the Clyde in Scotland.

Now and then, say de Havilland mechanics, they find evidence that the Comet's engines have consumed birds in flight. The compressors calmly chewed them up and spat them into the fiery furnace.

Centrifugal-Flow Compressor

This can happen because the Ghost has a big, rugged, single-sided compressor of the centrifugal-flow type to build the air up to several atmospheres before it is burned. Unlike the axial-flow compressors used in some U. S. and British military planes, the Ghost has no tiny blades arranged in stages that might be stripped off by the entry of a foreign object. And it is de Havilland's opinion that safety considerations will forbid the use of axial-flow compressors in any of the world's jet transports, despite their greater efficiency.

Four turbines are placed so close to centerline of plane that even if two on one side cut out, pilot has little trouble maintaining straight, level flight. Fuselage is circular.

Here's an innovation in air liners—a fuselage that hugs the ground. Short landing gear is possible because there are no props. Four-wheel main gear will replace present two wheels.

Comet is so "clean" aerodynamically that large flap area is needed to cut landing speed. Although this speed has not been announced, it is below that of comparable piston-engine transport.

The Comet's engines are snugged in so closely to the fuselage that there's no need for the customary trim tab on the rudder. A tab is a little supplementary control surface that a pilot cranks up when one or both engines cut out on one side. The tab makes up for the uneven pull on the wings. In the Comet, the thrust of all the engines is so close to the centerline of the plane that the pilot can hold her straight and true with a rudder pedal. It handles like a Cub.

But the Comet requires items a piston-engine plane doesn't need. There is a brace of rockets, for example, between the aft ends of the two pairs of gas turbines, each developing 5,000 pounds of supplementary thrust for short periods. They are there because jets are sensitive to changes in the air's temperature and density and may loiter on take-off when it's hot BOAC may need that extra thrust on sizzling days in equatorial lands.

Elaborate Pressurizing

Provision also must be made for humidifying the air admitted to the Comet's passenger lounge, because the air up in the stratosphere is too dry for human consumption. And the most elaborate pressurizing equipment ever put into a commercial airplane is needed to fly 'way up there.

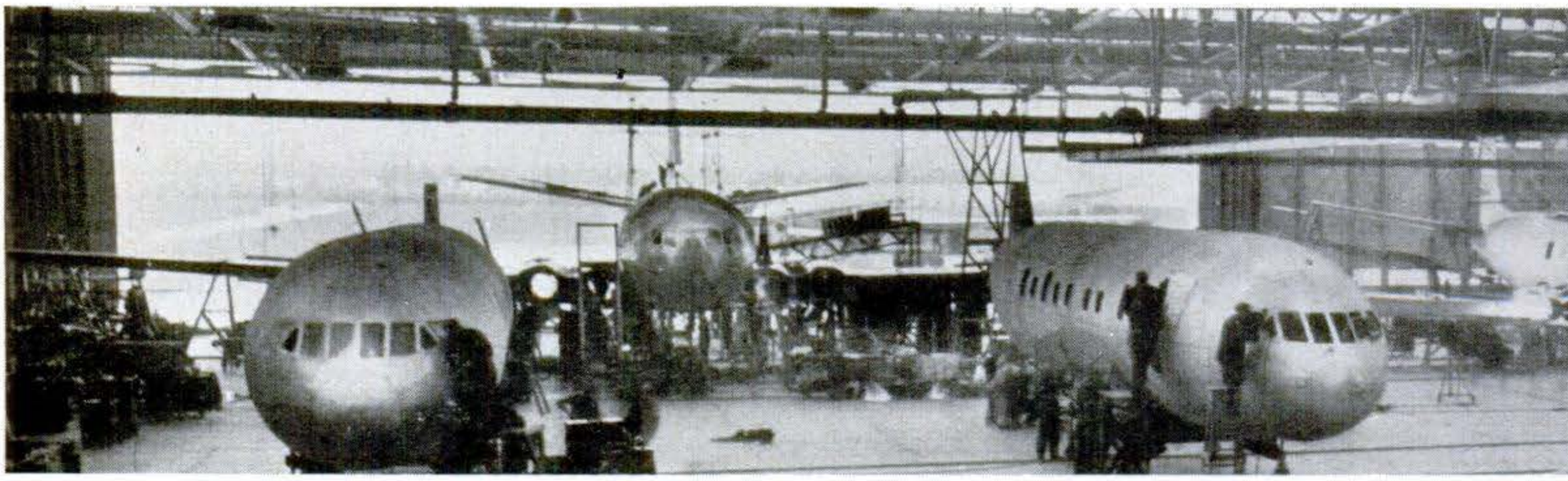
At 40,000 feet the pressure of the atmosphere is only 2.92 pounds per square inch. That's less than a fifth of what it is at sea level. The fuselage of the Comet must take a pressure differential of 8¼ pounds to the square inch, or more than a half-ton of pressure to every square foot of airplane skin.

Safety Problems

Medical authorities aren't quite sure yet what would happen to a man if a window suddenly blew out at 40,000 feet. But de Havilland engineers are taking no chances. They have been testing a Comet window for 18 months.

During the working day this window is subjected to the pressure differential of the stratosphere. At night the pressure is removed and a workman cleans it. This is done on the theory that the abrasion of cleaning may have had something to do with the window and astrodome failures of pressurized U. S. transports in the last couple of years. No laboratory failure has been registered as yet.

Another problem is what to do about gusts at high speed. These occur even in perfectly clear air. The Comet already has encountered one, and it was a dilly. When a DC-3 hits a downdraft or updraft, it wallows and shudders but the passengers don't



Comet production line at de Havilland's Hatfield plant shows that England is in the jet-

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feel as though they had been struck with a mallet. When a plane doing 400 to 500 miles an hour smacks into the same thing, it's like riding rough water in a speedboat. Some of the experts think that the passengers' seats will have to be shock-mounted.

The Load Is Limited

And how about fuel consumption?

At cruising revolutions—9,000 to 9,500 per minute—the Comet's four engines use 1,300 gallons of fuel an hour. If that were gasoline, it would take an American auto around the world.

The Comet, with its tanks full of 7,200 U. S. gallons of fuel, will be able to fly 5½ hours and have enough left to stay aloft another 40 minutes in an emergency. Lockheed Constellations are now carrying payloads averaging 10,780 pounds across the Atlantic. But de Havilland engineers estimate that their plane's payload on the 2,116-mile trans-Atlantic flight from Prestwick, Scotland, to Gander, Newfoundland, will be limited to an average of 8,750 pounds—36 passengers, luggage, and mails.

The necessarily thicker skin on a jet transport's wings and heavier internal structure just about cancels out any advantage in thrust per pound of weight offered by the gas turbine over the piston engine and propeller. The skin has to be thicker because its shape at high speed is critical. Remember that wrinkling you used to see on the top of the wing of the old DC-3 when it hit a bump? A jet pilot can't afford a wrinkling skin. The air flow around the wing must be smooth to maintain proper lift.

De Havilland recently has run into a new kind of problem, too. At high speed the air on the top of the Comet's swept-back wing tends to slide diagonally toward the tip.

That disturbs what is known as the laminar flow and robs the wing of some of its lift and stability. So the company is experimenting with various types of "fences." These are solid strips of metal several inches high mounted perpendicular to the wing surface and extending back from the leading edge. They are intended to keep the air flow going straight from front to back.

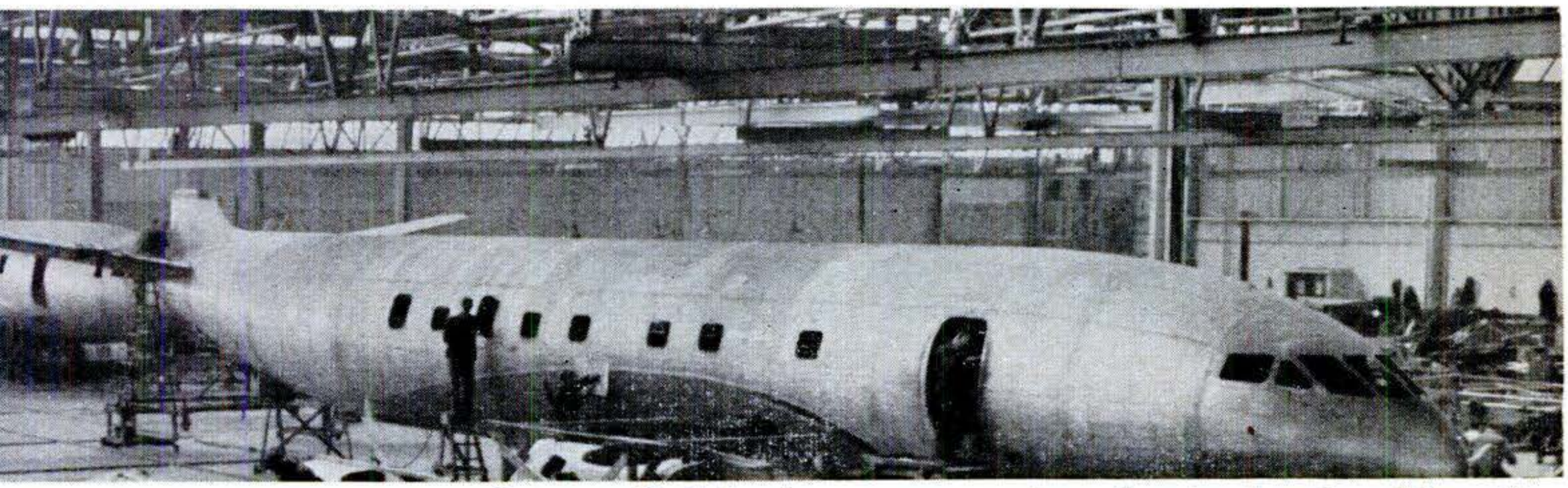
Extending back from the leading edge of the Comet's swept-back wing are "fences"—solid strips of metal, one of which is shown above, to keep air flowing straight back at high speeds.

Stooging Wastes Paraffin

The answers to jet-transport problems are coming. One will be engines that use less fuel. Another may be tanks in the fuselage. To save kerosene ("paraffin" to the British), tractors may tow jet transports to the runways. And pains will be taken to avoid being stacked (the British call it "having to stooge") over airports.

Stacking, when necessary, will have to be done at 20,000 feet where the gas turbines waste less fuel. As for "going around again" when a pilot misses his approach, the de Havilland engineers say adequate thrust for quick emergency acceleration is available. The engines are kept at a fairly high r.p.m. when the plane comes in, and speed cut for landing by extra-extensive flaps.

Huge airports are not needed. Lightly loaded, the Comet has become airborne, the pilot has chopped the throttles, and the plane has been landed and stopped, ➧



transport business in a big way. U. S. has long way to go from drawing board to this reality.

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on a runway a little more than 6,000 feet long.

The Comet's huge wings are one reason for its exemplary behavior. The wing loading is only about 50 pounds per square foot as compared with 80 pounds on the latest U. S. air liners. Perforated air brakes on both the top and bottom of the wing enable the pilot to glide at a steep angle without building up too much forward speed.

Canada, too, has a jet air transport flying. It is the Avro Jetliner. Although not as streamlined as the Comet, it is perhaps even farther advanced as a piece of commercial air-line equipment Its cruising speed is 450 m.p.h. at 30,000 to 35,000 feet. Four Rolls-Royce Derwent-5 engines each give a thrust of 3,500 pounds. It weighs 20 tons less than the Comet, but will carry 50 passengers for shorter distances.

And Cheaper, Too

And what will it cost to ride in jet transports?

Possibly less than in other air liners, the jet enthusiasts predict, because the planes go so fast that they'll be able to make more trips and thus haul more cash customers than piston-engine rivals. Hauling a ton a mile will cost only four-fifths as much in the Comet, de Havilland experts say, as in those slowpokes now in use. END

Uncle Sam Would Like To See Them Make . . .

YOUR Uncle Sam has some dream projects, too. And he'd like the basement-shop inventors to go to work and make them reality.

Mostly they're military gadgets many steps ahead of anything anyone has made yet. Here are a few samples, taken from a list prepared recently by the National Inventors Council.

Communication. Not satisfied with radio, telephone, and telegraph, the military would like a "revolutionary" new means of communication. Says the Council, "Present systems in general depend on electrical impulses, electromagnetic waves, sound waves, etc. A system utilizing completely new concepts is desired." Simple?

Death Ray. The soldier's dream—or nightmare—a portable death ray that would be lethal at 500 yards or better, and without the excessive amounts of power present techniques would require.

Mechanical Secretary. A gadget, not too bulky, that would automatically translate ordinary speech into the written word. Soldiers would like it to speed up communications and to intercept enemy wire and radio messages. Apparatus using known techniques would be too cumbersome and complicated.

Portable Steam Generator. For Arctic warfare the services would like a portable outfit that would spray a jet of steam hard enough to dig holes in frozen ground for anchors, foundations, artillery emplacements—and graves. It should also be able to thaw large areas so that earthmoving machines could build airstrips.

Rooters. Another big aid in the Arctic would be a lightweight, high-speed jackhammer for chopping up frozen ground or muskeg to use in place of gravel for building roads, runways, bridge approaches, and similar installations.

Snow Melter. To keep roads and airfields clear, they want a chemical that will melt snow or ice at temperatures as low as −65° F., and it must not corrode metals as present melting compounds do.

Snow Packer. A chemical or mechanical device that would quickly pack snow solidly enough to be used by tracked or wheeled vehicles and planes.

Windshields. Must be as hard as glass, nonglare, shatterproof, fogproof, and iceproof, preferably without using a heating device or any surface coating.

If you have any ideas on how to fill these orders—or if you want a copy of the full list of ideas sought—drop a line to the National Inventors Council, Department of Commerce, Washington 25, D. C. It's an advisory group of top scientific research people, headed by Charles F. Kettering. The Commissioner of Patents sits on the council so you needn't worry about someone making off with your brainchild.

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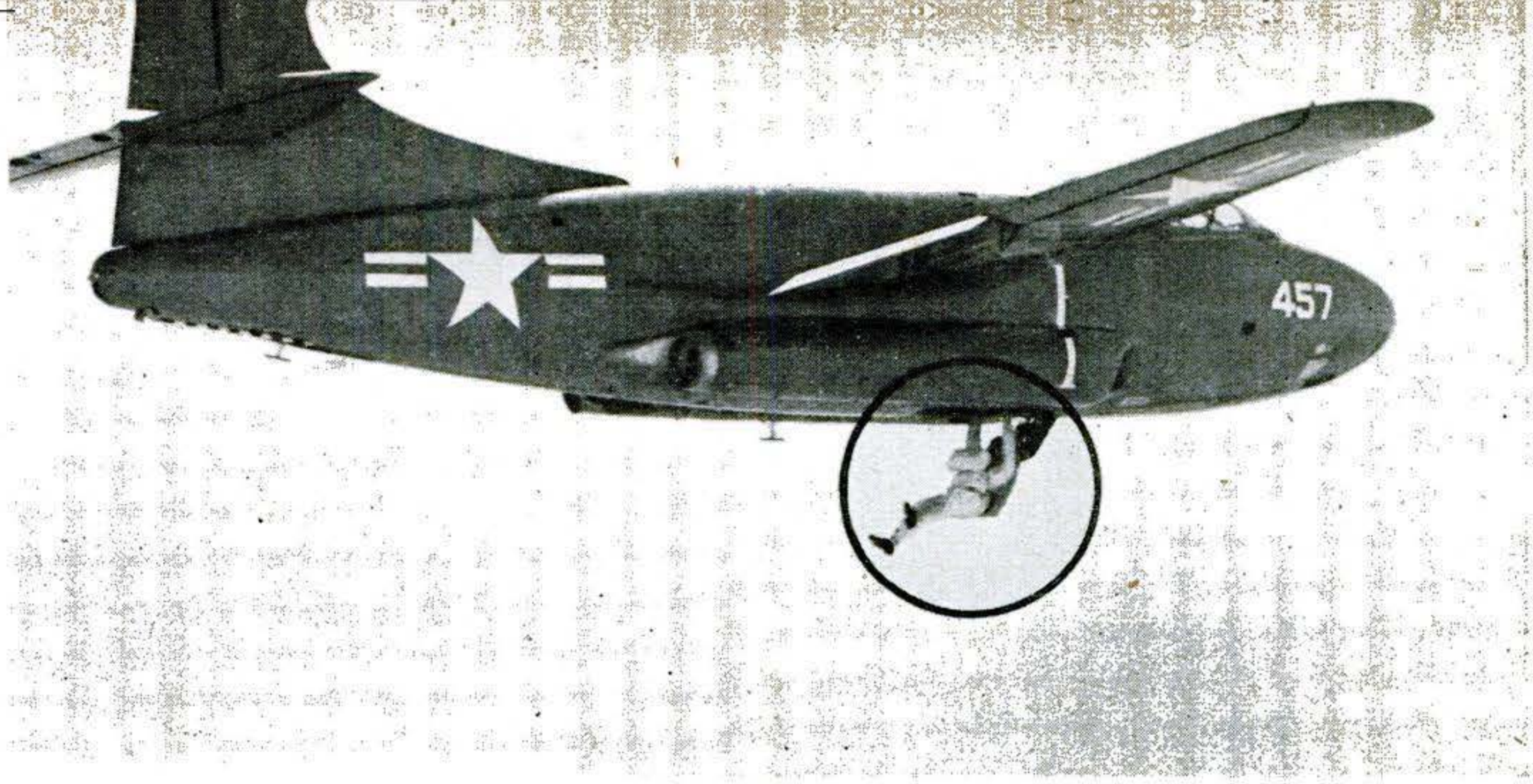


Pilot Slides to Safety

A CHUTE under the forward fuselage of this Douglas Skynight makes a quick escape exit in case of an emergency. The belly-bail-out eliminates any danger of the two-man crew striking the tall tail of the XF3D-1 twin-engine Navy fighter, always a possibility in a conventional cockpit escape. The chute is one of many new escape devices being tested by the Navy. Another, for high-speed jets, is shown on page 131.

Pedal Power Raises Platform

WORKMAN in "bosun's chair" at left controls his own ups and downs by means of bicycle pedals. His foot power is transmitted to a winch that raises or lowers the platform as fast as 25 feet a minute. He is protected by three independent braking devices. The "cage," with a capacity of 625 pounds, is made of rigid tubular steel. Made by Safway Steel Products, Milwaukee, the hoist can be rigged by one man.

Variable Choke Built on Gun

A TWIST of the wrist adjusts the spread of shot from this gun (right) to concentrate on targets at any distance within range. To narrow shot pattern, you can screw down the knurled sleeve on the muzzle (upper photo) from full cylinder (for targets up to 20 yards) to full choke (40 yards or over). The manufacturer, O. F. Mossberg & Sons, says the three-shot 20-gauge is the first shotgun with a variable choke as standard equipment.

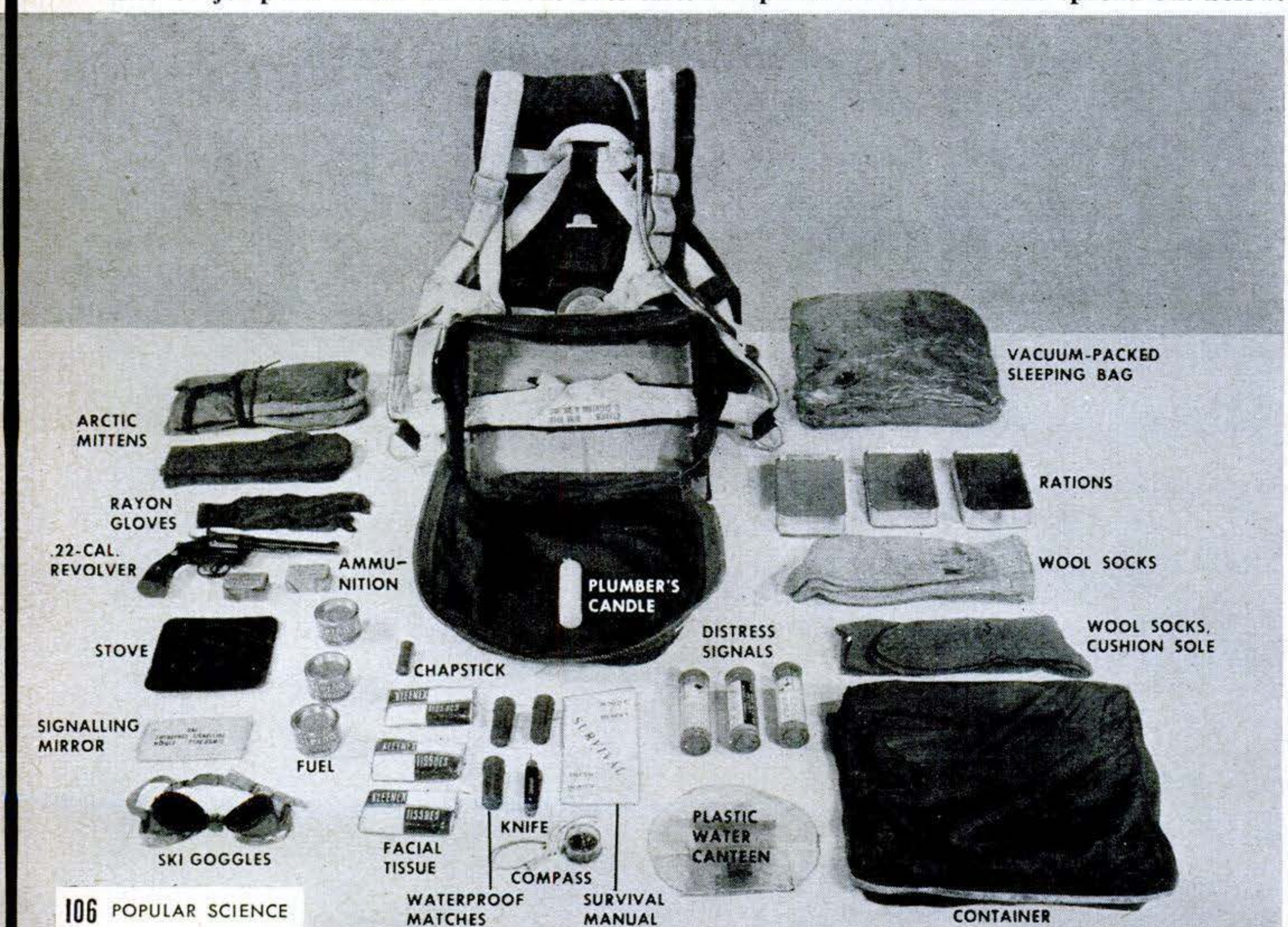
The new kit is a zippered container attached to the seat sling of a parachute harness. One side, curved and covered with foam-rubber padding, serves as a comfortable seat in flight.

Jet Pilots Pack New Arctic Kit

RECENT Arctic maneuvers headlined the importance of personal equipment that will permit human survival at temperatures far below zero. For the jet fighter pilot, that means not only warm clothing, but squeezing into the tight confines of his cockpit a sustenance kit that will keep him alive in case of an emergency landing or a bailout over Arctic wastes. The Air Force has come up with the answer—a streamlined kit packing 22 essential items and doing double duty as a comfortable seat during flight.

Weighing only 24 pounds, contents of the kit includes a sleeping bag that will keep its occupant warm at temperatures down to −40° F. Vacuum-packed, the bag takes up 40 percent less space than if it were hand-rolled, leaving room for the many other items, including food rations for 10 days. Developed by the Air Material Command, the kit will be standard issue for all fighter pilots assigned to cold climates. The same seat-type container will be used for tropical survival kits.

Life of jet pilot forced to bail out over Arctic depends on the 22 items spread out below.



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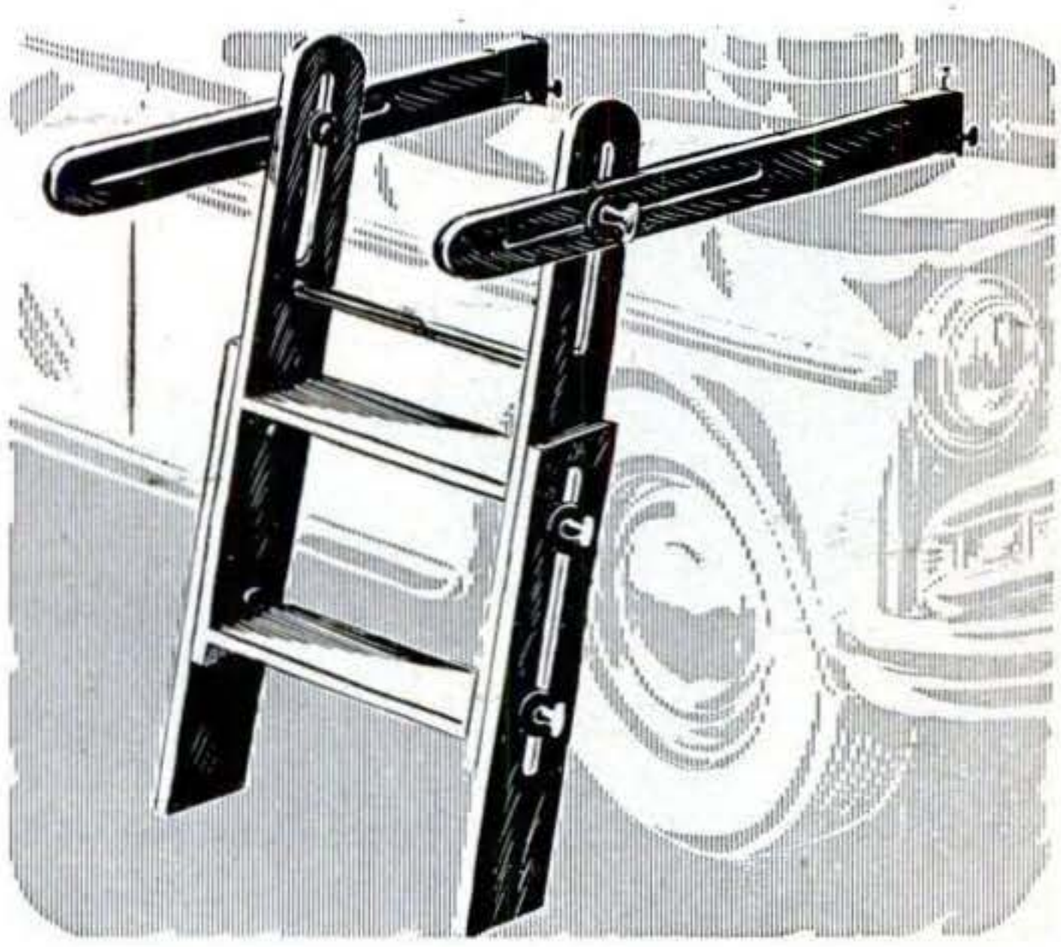
New Ideas from the Inventors

1 Device to Teach Sports. By trying to duplicate the movements of an expert, a tyro using this trainer should be able to improve his skill at golf and similar sports. A movie film showing correct form is projected on a semitransparent screen placed behind a transparent mirror. The pupil, standing before the mirror, tries to match his motions as reflected in the mirror with those on the screen.

2 Thermometer to Clip on Tap. Keeping tap water just at the temperature you want would be no trick with this thermometer designed to be clipped right on the nozzle of a conventional mixing faucet. The thermometer's bulb projects into the water stream and the temperature can be read on the vertical scale.



3 Ladder to Aid Mechanics. Engines set deep in car hoods would be easier to get at for repair and adjustment with the ladder shown. Both the vertical legs and the horizontal supports can be adjusted to bridge the widest fenders on modern cars. Two screw clamps on the supports hold the ladder firmly in place.

Turn the page, please, for three more new ideas

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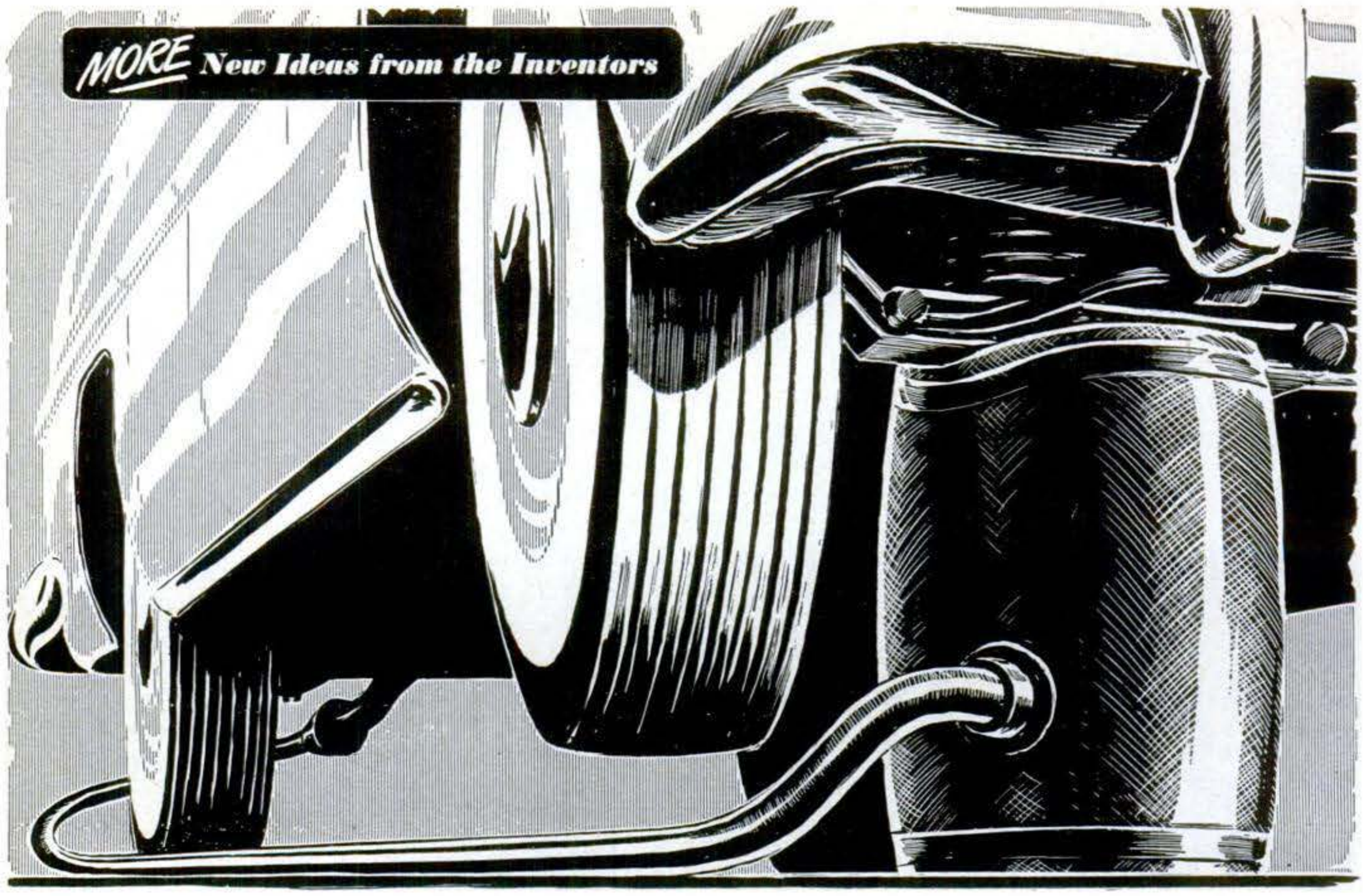
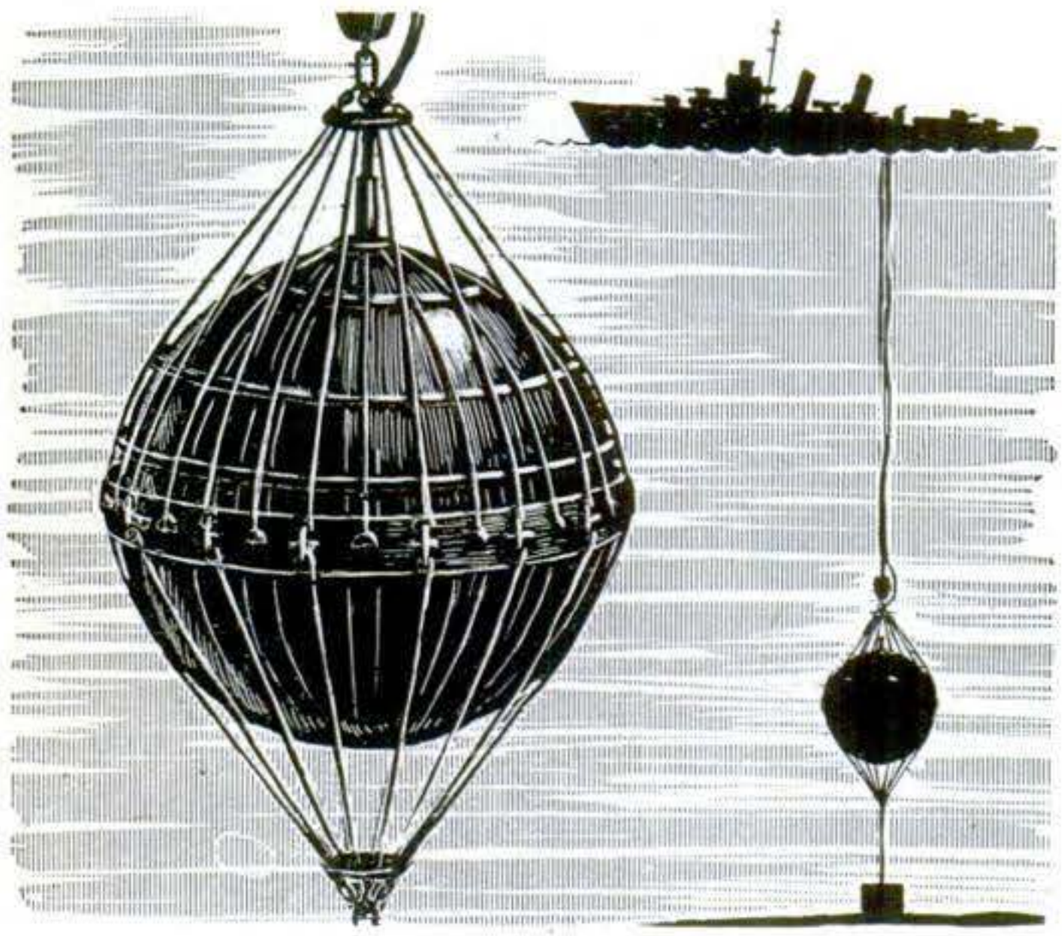
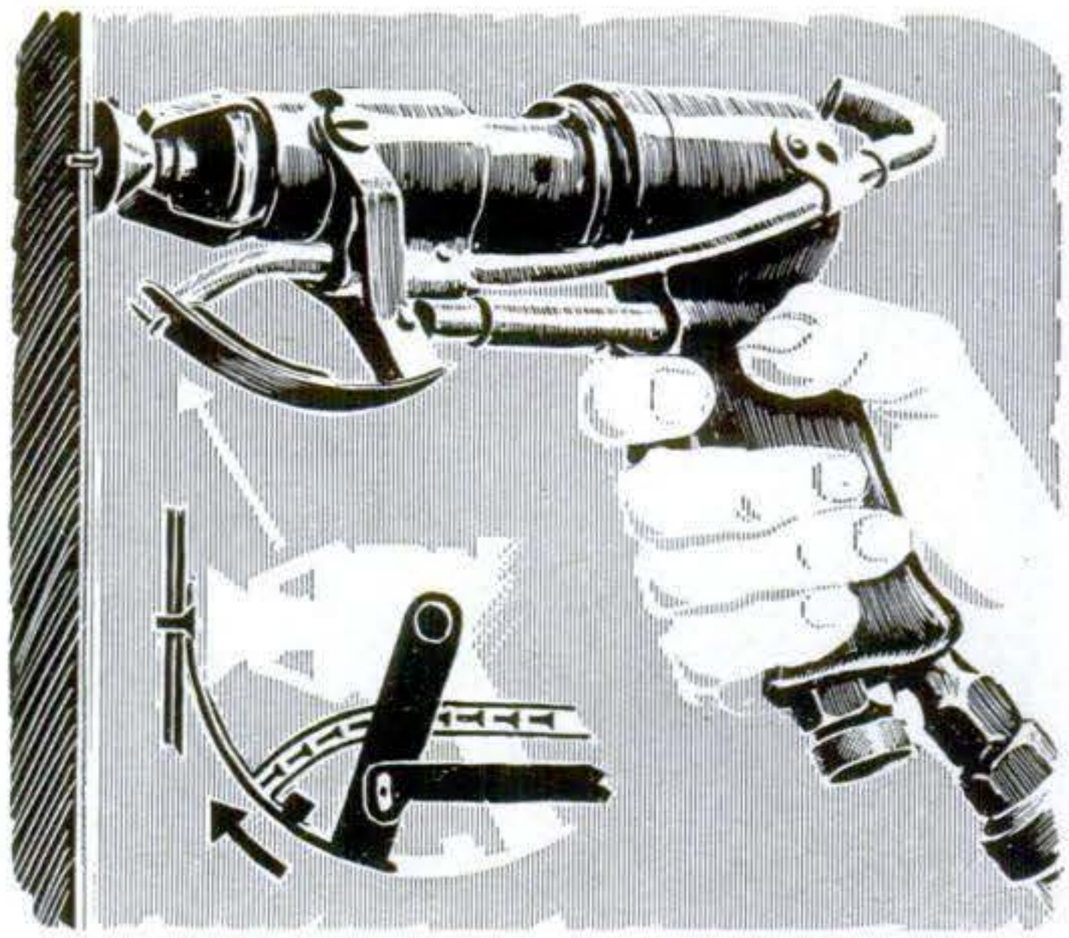
MORE New Ideas from the Inventors



4 Exhaust to Raise Car Jack. Gases from a car's exhaust would provide the lifting power for this pneumatic jack. It consists of an inflatable cylindrical bag that is placed under the axle end to be raised and connected to the car's tail pipe by means of a tube and a self-tightening connector. Idle your car's engine, and the jack is raised in 15 seconds. Turning valve drops it in 5 seconds.



5 Sea Cells to Fuel Craft. This "balloon" would supply fuel to surface and air craft without a pump. Anchored underwater, the fuel cell would be squeezed by water pressure, and the fuel, lighter than water, would be forced up to the surface nozzle. Moored in remote areas, the cells would be hidden from an enemy.



6 Air Gun to Feed Rivets. To speed up riveting operations, this air gun has its own automatic rivet feed. Link-operated fingers fed from a rivet magazine move a new rivet into place in front of the air hammer each time the trigger is released to shut the gun off. A rivet always is in place for use.

Patents on these inventions have been granted to: 1. C. H. Robertson, W. Lafayette, Ind.; 2. W. Stewart, and M. Psilos, Springfield, Mass.; 3. A. R. Ross, Renton, Wash.; 4. J. H. Cox, Seville, and R. L. Miller, Akron, O.; 5. H. T. Bogle, U.S. Navy; 6. H. M. Griffin, Webster Groves, Mo.

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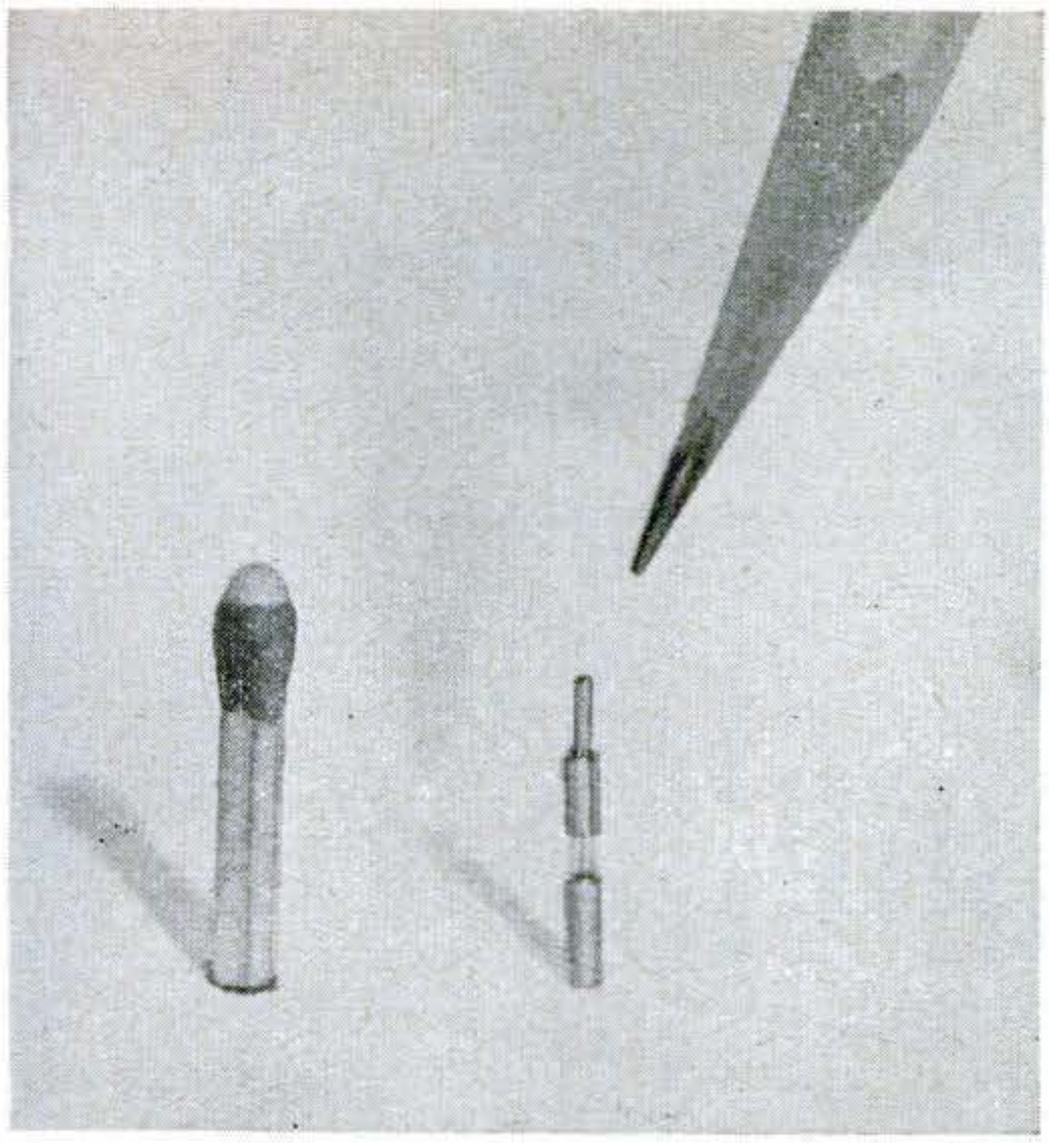
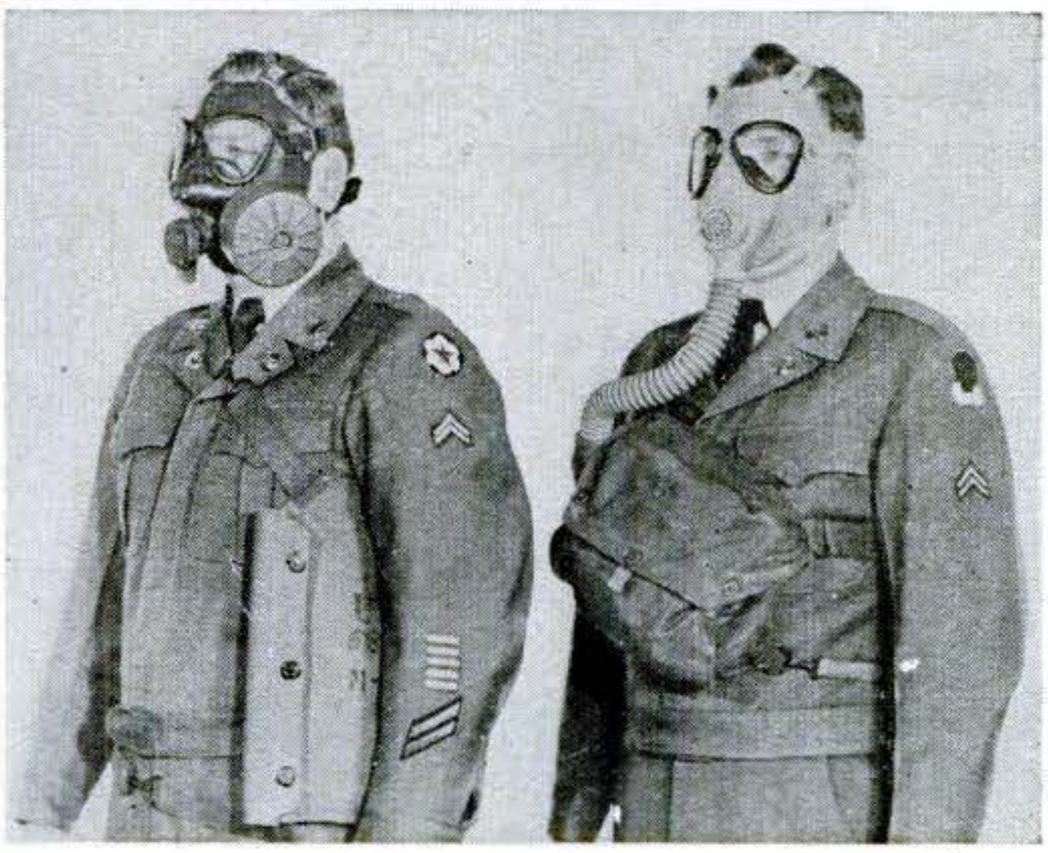


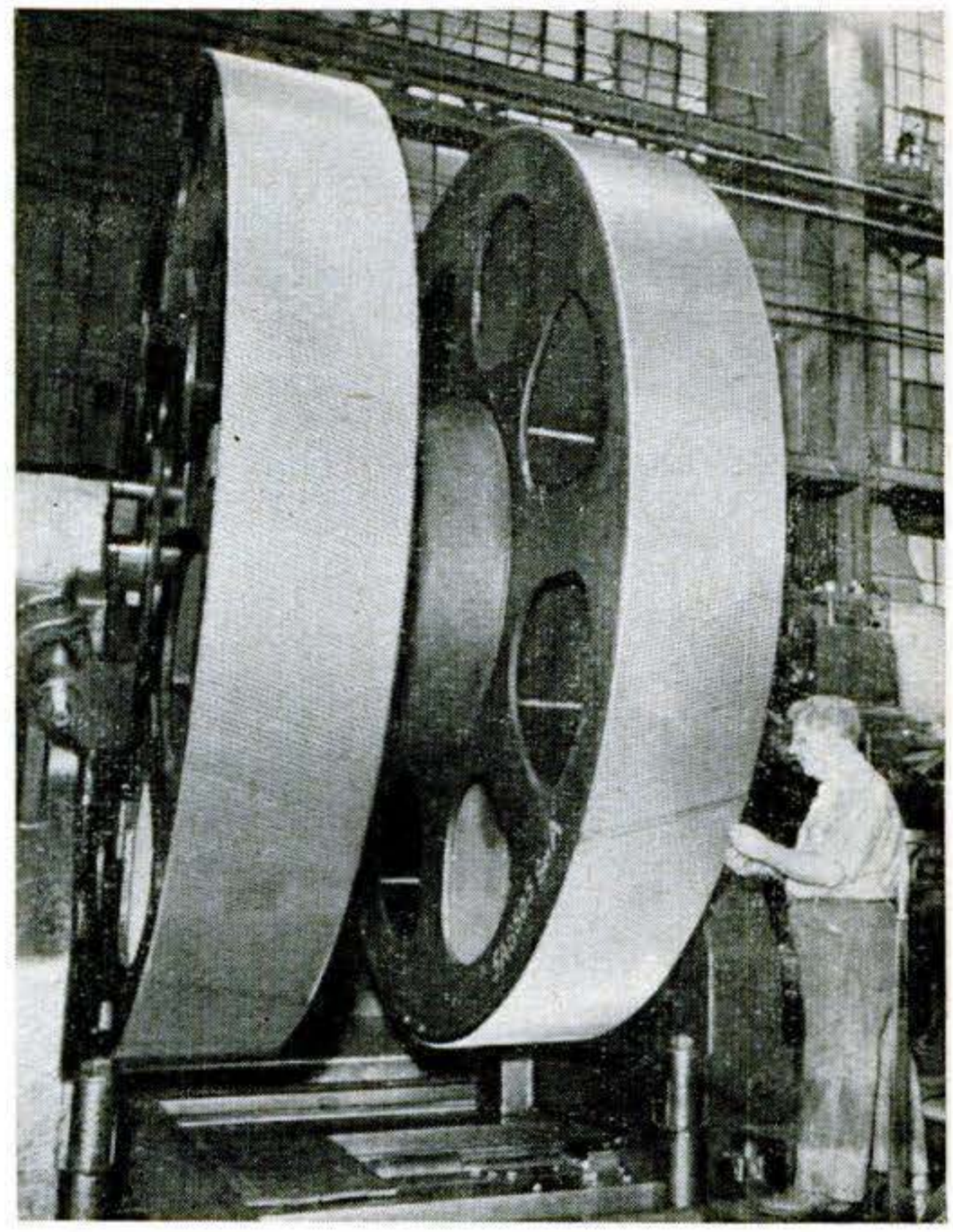
Tiny Tubes Lighten Aircraft

THE tiny object above, dwarfed even by the match head beside it, is a complete radio tube—1/90 the size of a conventional tube. Developed by the USAF's Air Materiel Command, the "Tom Thumb" tubes are expected to save valuable weight and space in aircraft requiring hundreds of radio tubes. The small current drain of the tubes, called "fieldistors," is expected to eliminate much power-supply equipment formerly needed.



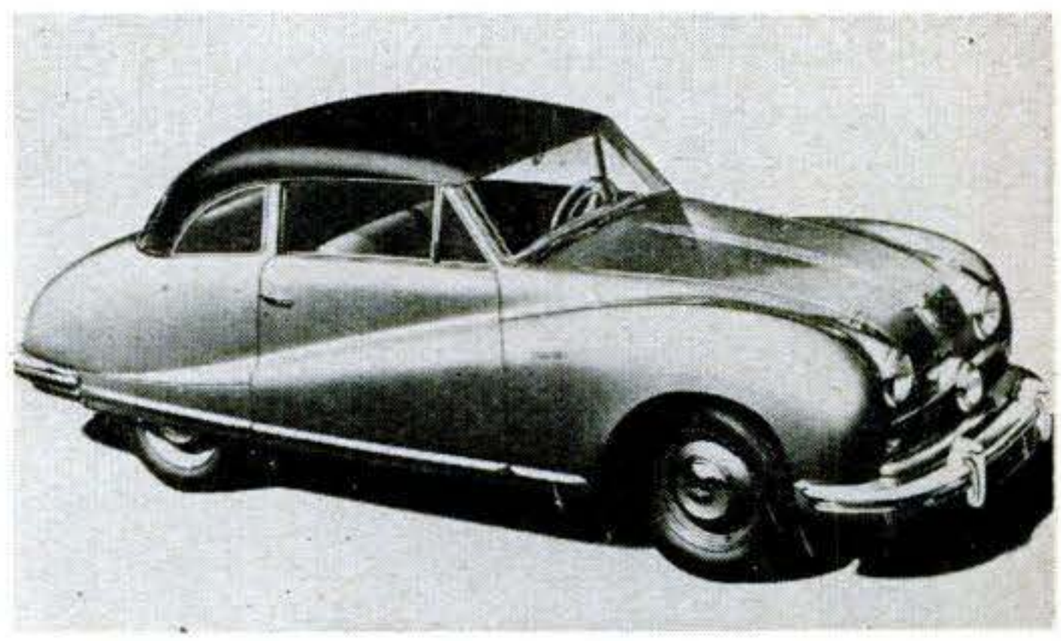
Army Gets New Gas Mask

U. S. SOLDIERS will soon get a new lightweight gas mask, at left above. Unlike its predecessor, at right above, the new model requires no cumbersome hose: its air-purifying canister is attached directly to the facepiece. The carrying case, worn out of the way at the side, is said to be so watertight that it helps buoy troops making landings.



Big Gear Goes To Dentist

THIS giant marine reduction gear, 13 feet in diameter, is getting a final dental job on its more than 700 teeth. The cutting process, which takes about three weeks, goes on without stopping because if the metal were allowed to cool and contract, all subsequent teeth would be slightly out of true. Built by Westinghouse, the 53,000-pound gear will transmit power from an 18,000-hp. steam turbine to the propeller of a new oil tanker.



Austin Has Sports-Car Lines

THIS new British Austin is designed to have the sporty appearance of a convertible with the hard top and greater roominess of a sedan. Its 88-hp., high-compression engine is said to hold 63 official AAA stock-car records for speed and endurance. Also featured in the new car are an adjustable steering wheel and a rear window that opens.

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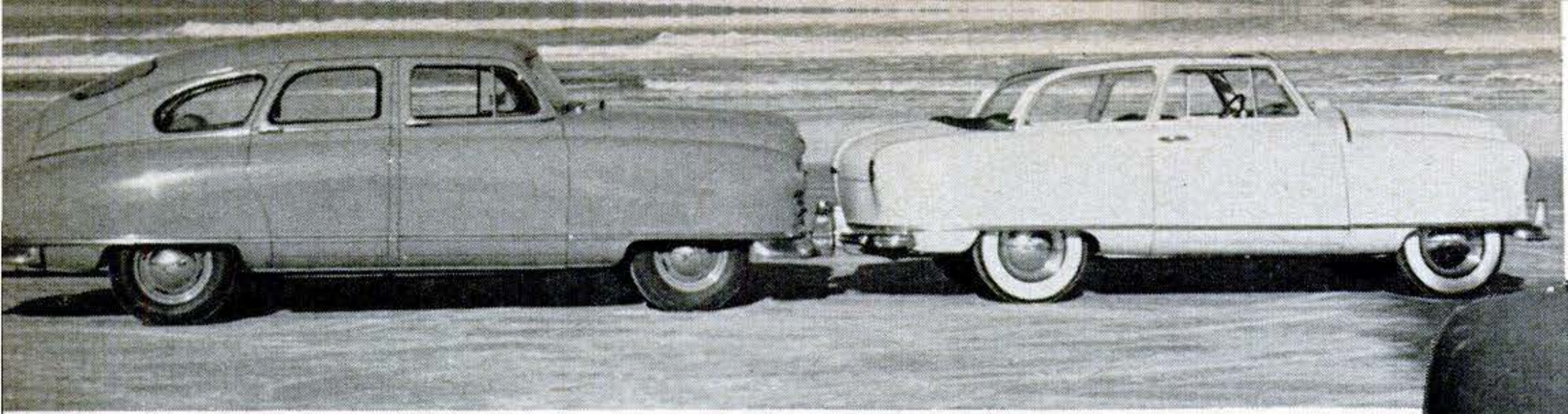
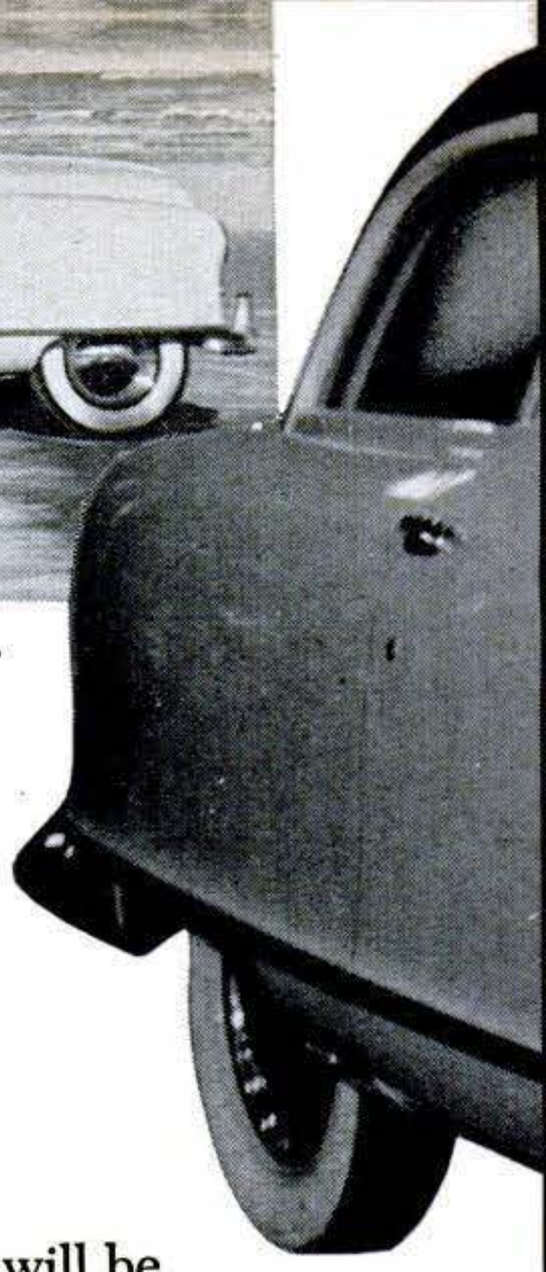


Size of new Nash Rambler (right) is shown by contrast with Nash Statesman.



Meet the "Rambler"

This new smaller Nash is a plush job, not a stripped-down midget. It seats five, gets 30 miles to a gallon.

By Devon Francis

PS photos by W. W. Morris

THE smallest "standard" American-made car offered the public since automobiles began swelling out before the war was introduced last month by Nash Motors. A convertible, it seats five persons, cruises nicely at 65 m.p.h., and gets 30 miles to the gallon of gas. It's priced to undersell any other convertible, outside of a midget.

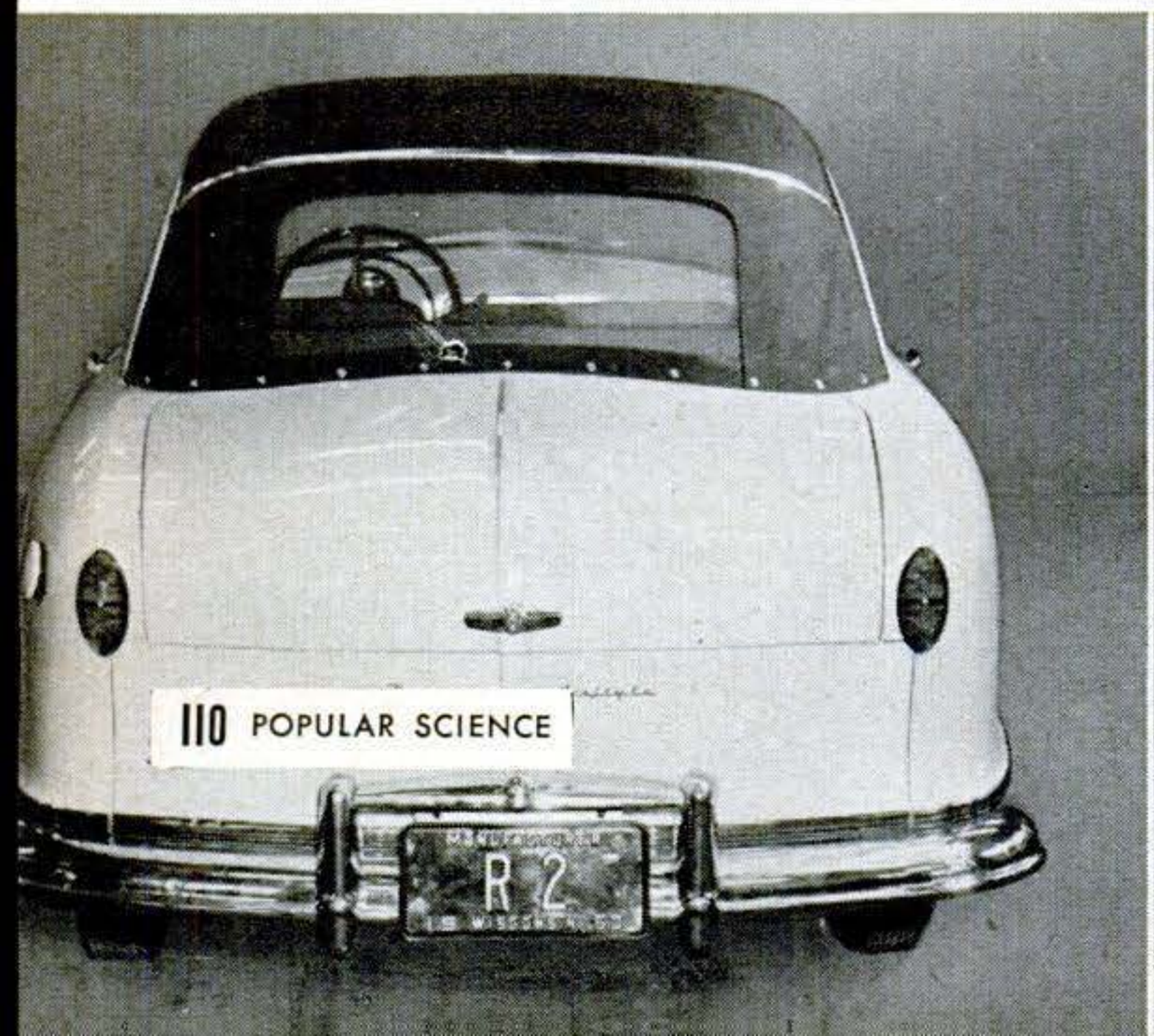
In an era of bigger and bigger automobiles, Nash has taken the bull by the horns. This car, at long last, approximates in size the old Model-A Ford. It answers the oft-asked question, "Why doesn't somebody bring out a smaller car that isn't in the midget class?" The convertible will be followed in June by a station wagon and, later in the year, by other models. All are expected to carry price tags below those of comparable models manufactured by the Big Three—Chevrolet, Ford, and Plymouth.

Not to be confused with the "little" Nash (PS, March '50, p. 130) that has been touring the country on a would-you-buy-it basis, this job is a full-scale, production automobile. As one company executive put it, "Here's a car that a lot of people can afford who otherwise wouldn't buy one. It's the old Model A priced on today's 52-cent dollar."

It has a 100-inch wheelbase as compared with 112 for the Nash Statesman and 121 for Nash's bigger Ambassador model. Overall length is 175 13/16ths inches, as compared with 201 and 210. It is three inches narrower, three inches lower, and has a

Trim convertible is 74½ inches wide. Rear window zippers out. Its 100-in. wheelbase compares with 96 inches for the British Austin Model A-70 and 94 for the British Standard Vanguard.

Five persons—three in front, two behind—can sit comfortably in Rambler. Front cushion is 58½ in. wide, rear one 44¼. Low hood lets driver see an object on road 21 feet ahead of car.



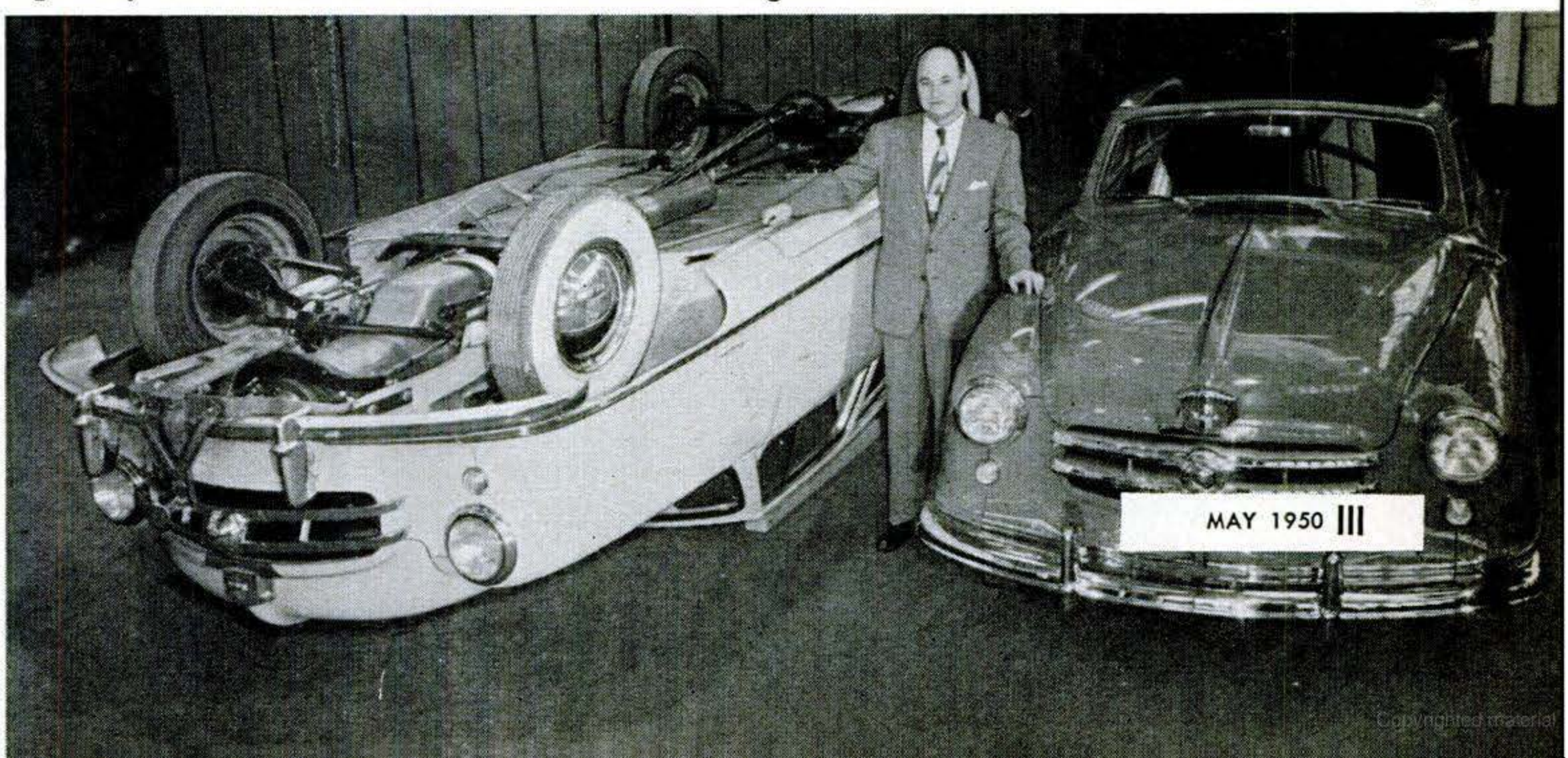
Rambler's lines substantially follow those of other Nash cars, with front wheels enclosed. Engine is same as that in 1949 "600" series but horsepower is upped to 82.

turning radius of only 19 feet. Its curb weight is 2,600 pounds, or 500 less than the Statesman.

But it is no stripped-down vehicle. Equipment includes everything offered in regular-sized automobiles. Presently it will be available with overdrive. It comes in two styles, the Super and the Custom. The Custom carries the extras—special upholstery and steering wheel, a radio, the Nash Weather Eye air-conditioning system, directional signals, a carpeted floor mat, a clock, and wheel-trim rings.

To get a lot of automobile into a restricted space, the company had to sit up nights with a slide rule. The front-wheel suspension is brand new in U. S. design. A way had to be found to get adequate

Strength of windshield pillars and roof-rail structure is demonstrated in photo below where car is turned on its back. Stunt, performed especially for POPULAR SCIENCE at Kenosha plant, is not recommended to owners. Suspension area on 2-inch rails was only a foot long. Righted, rails and supports were undamaged. Other car is a Custom Rambler.



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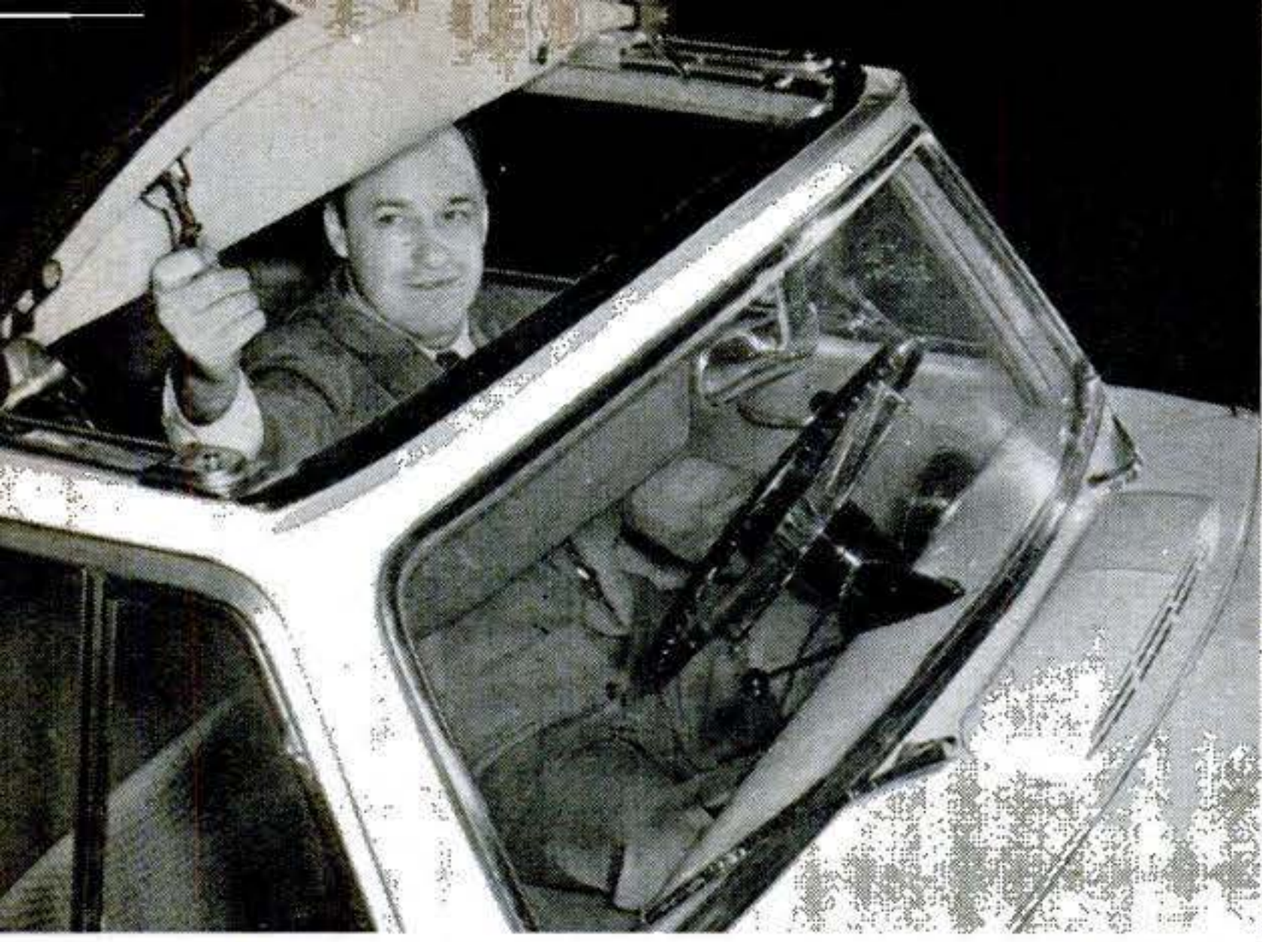
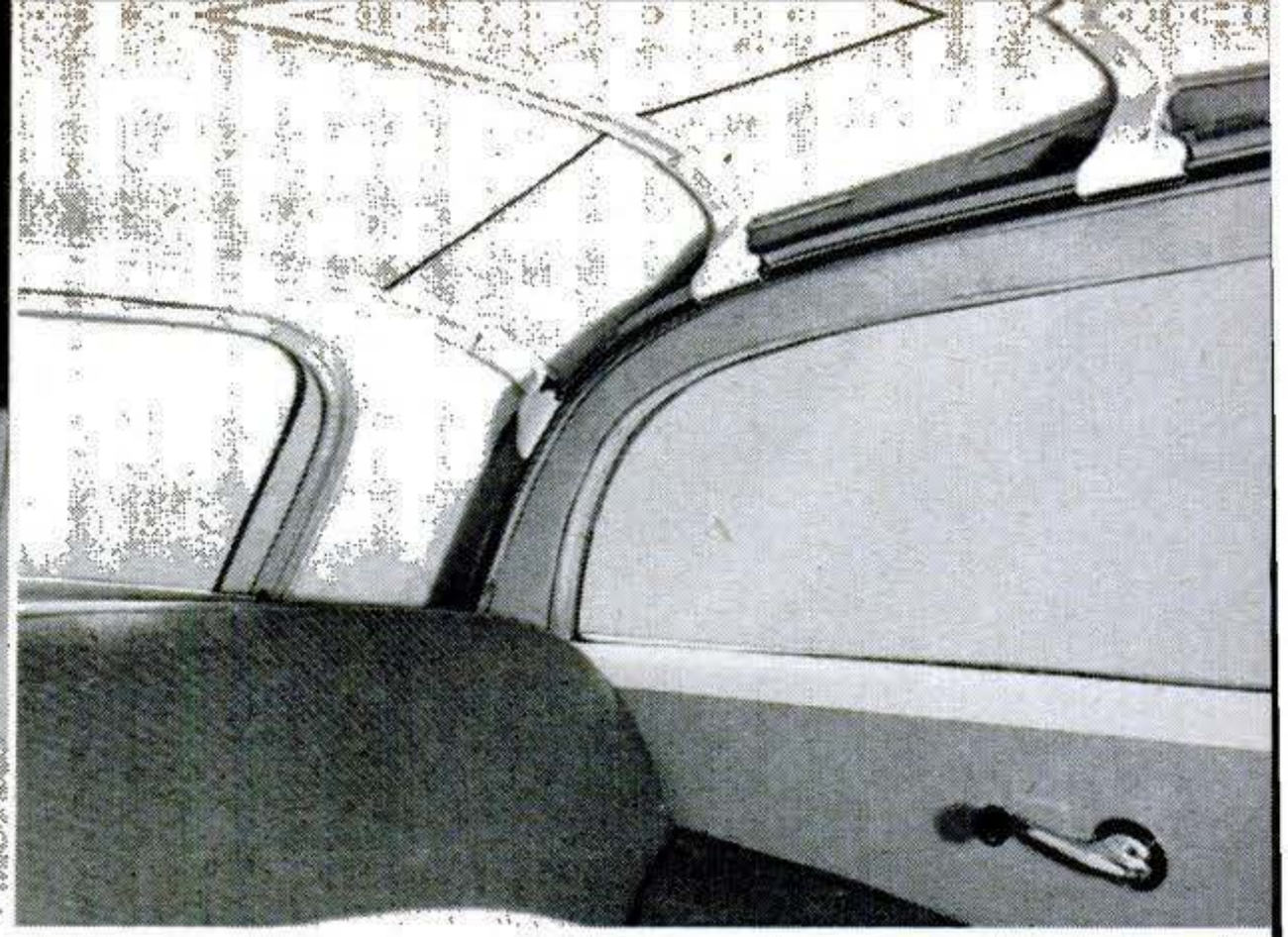
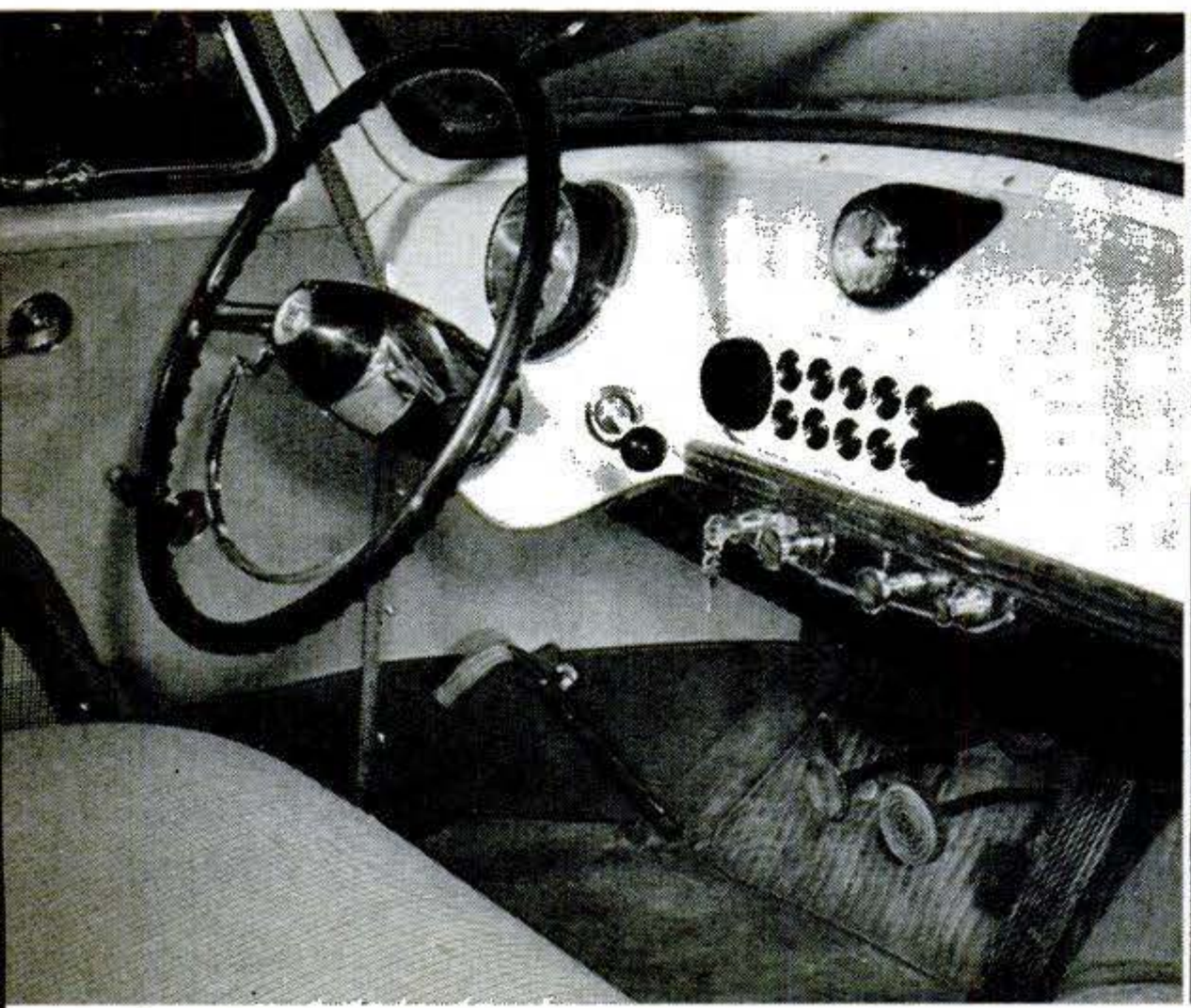


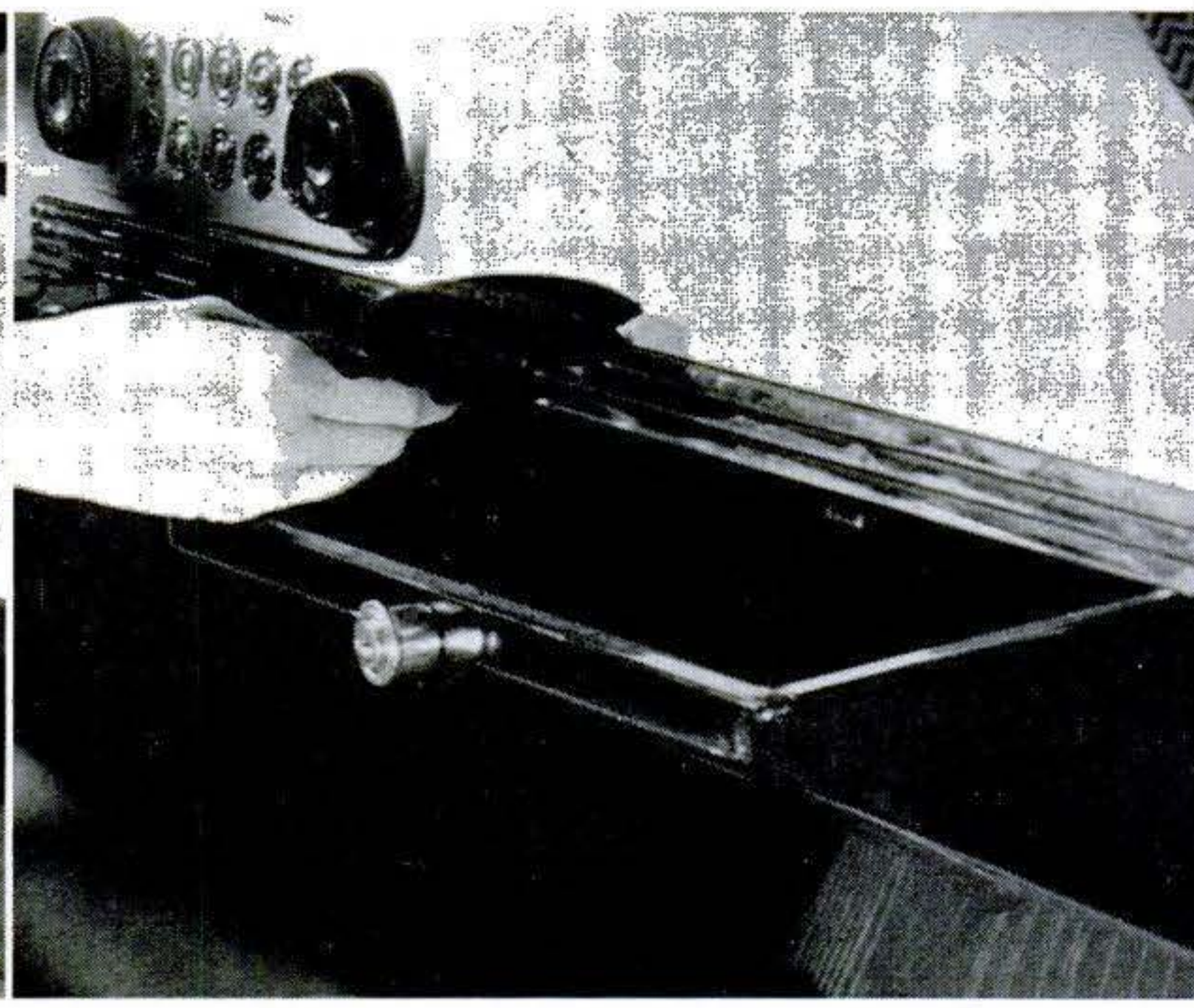
Fabric top latches automatically to windshield with plate hooks that engage pins in top rails. Man in driver's seat has his hand on one of two supplementary clamps securing the top.



Four intermediate bows, guided by structural rails, support top fabric. Junction of fabric and rails is snug, and top is taut when in place. Customary gutter at sides carries off rain.



Steering column spears through a projection of instrument panel on which gearshift and directional turn levers also are mounted. Short coupling puts driver within 20 in. of windshield.



Bin-type glove compartment is on right side of panel. Leg-room in front seat is greater than in regular Nash models, but tall man might feel cramped in somewhat restricted space in back.

passenger room. That meant moving the engine forward. But the front body cross-member in Nash's "Unitized" construction stood in the way. So the engineers eliminated it completely. They made a box of the front-end sheet steel, braced it, and hung the wheels, shocks, and springs right on the car envelope.

Both for body rigidity and safety, the windshield pillars and roof rails are permanently fixed structures. This is one convertible where you won't get body rattles. While roof rails don't have the strength of a solid steel top, they would supply some protection in a roll-over. Incidentally this gave Nash a chance to add an inexpensive and simple way to raise and lower the roof bows and fabric top.

The engine powering the car is no overworked little sewing machine, but an improved version of the same power plant that drove the heavier 1949 "600" models. It's an L-head six that delivers 82 hp. at 3,800 r.p.m. and works at a compression ratio of 7.25 to 1. With high horse-power-to-weight ratio, the car is agile in traffic.

Named the "Rambler" for the first car ever produced by Nash's predecessor company back in 1902, the new Nash has been subjected to many miles of "torture" driving on the test track and to 80,000 miles of open-road touring.

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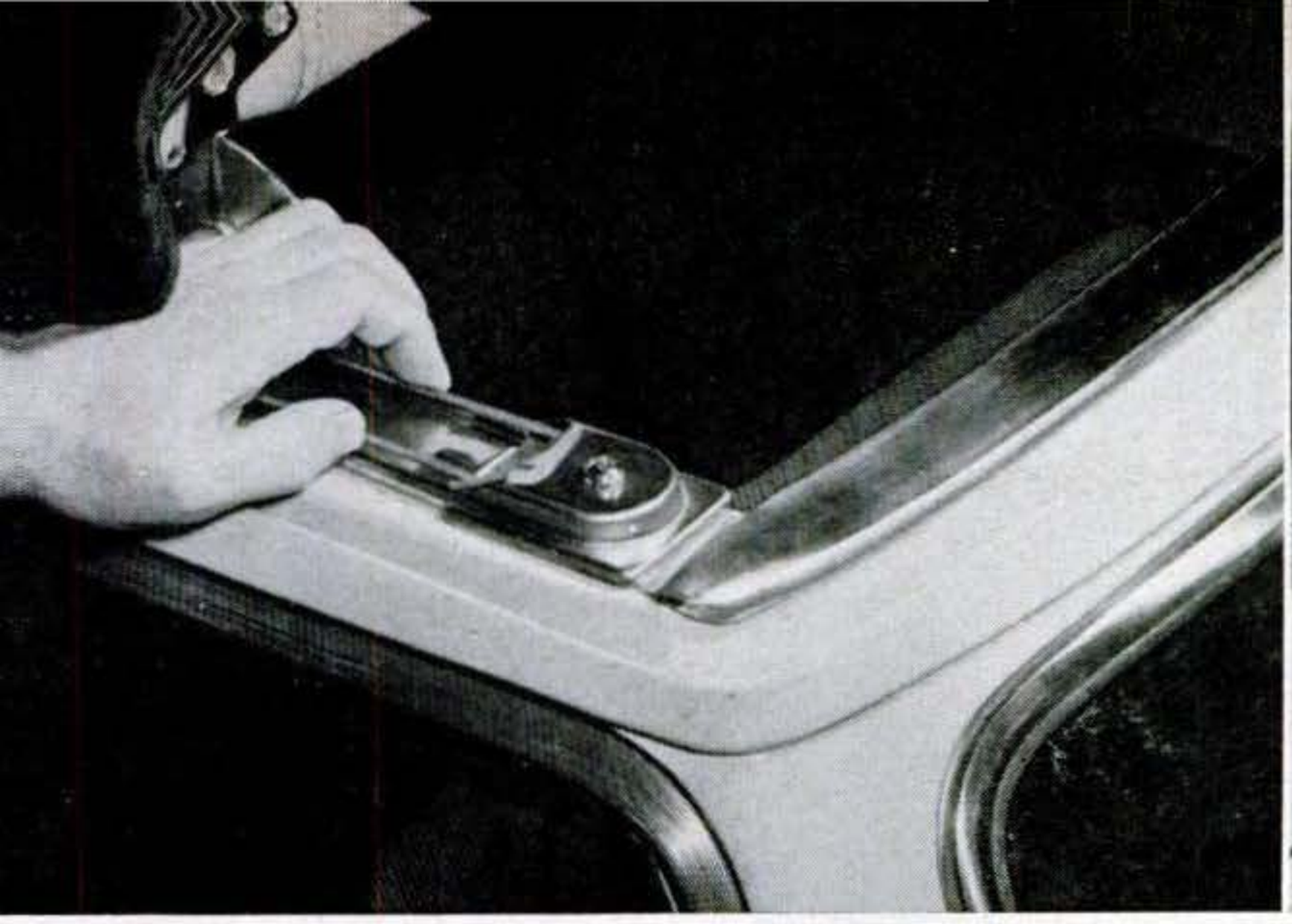
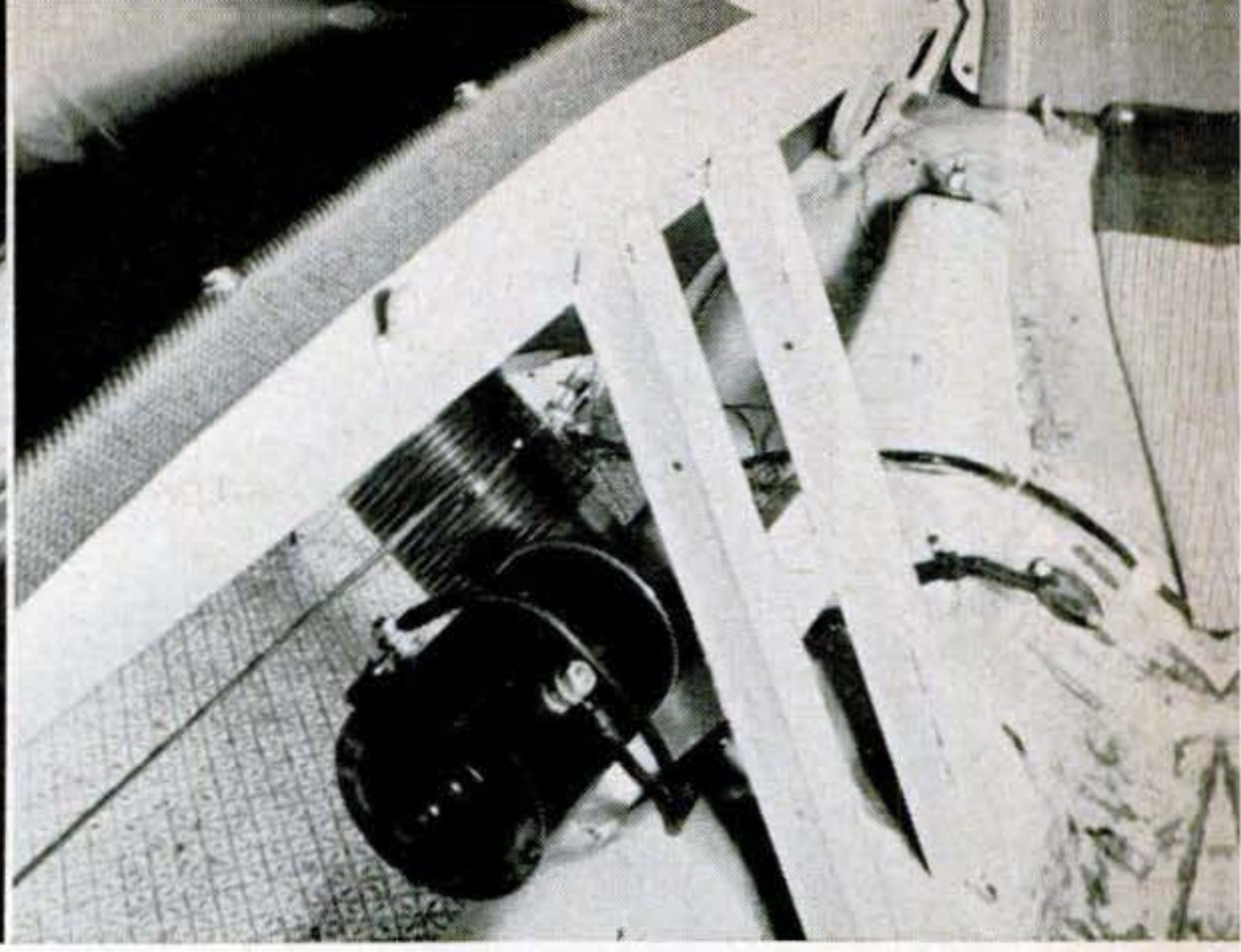
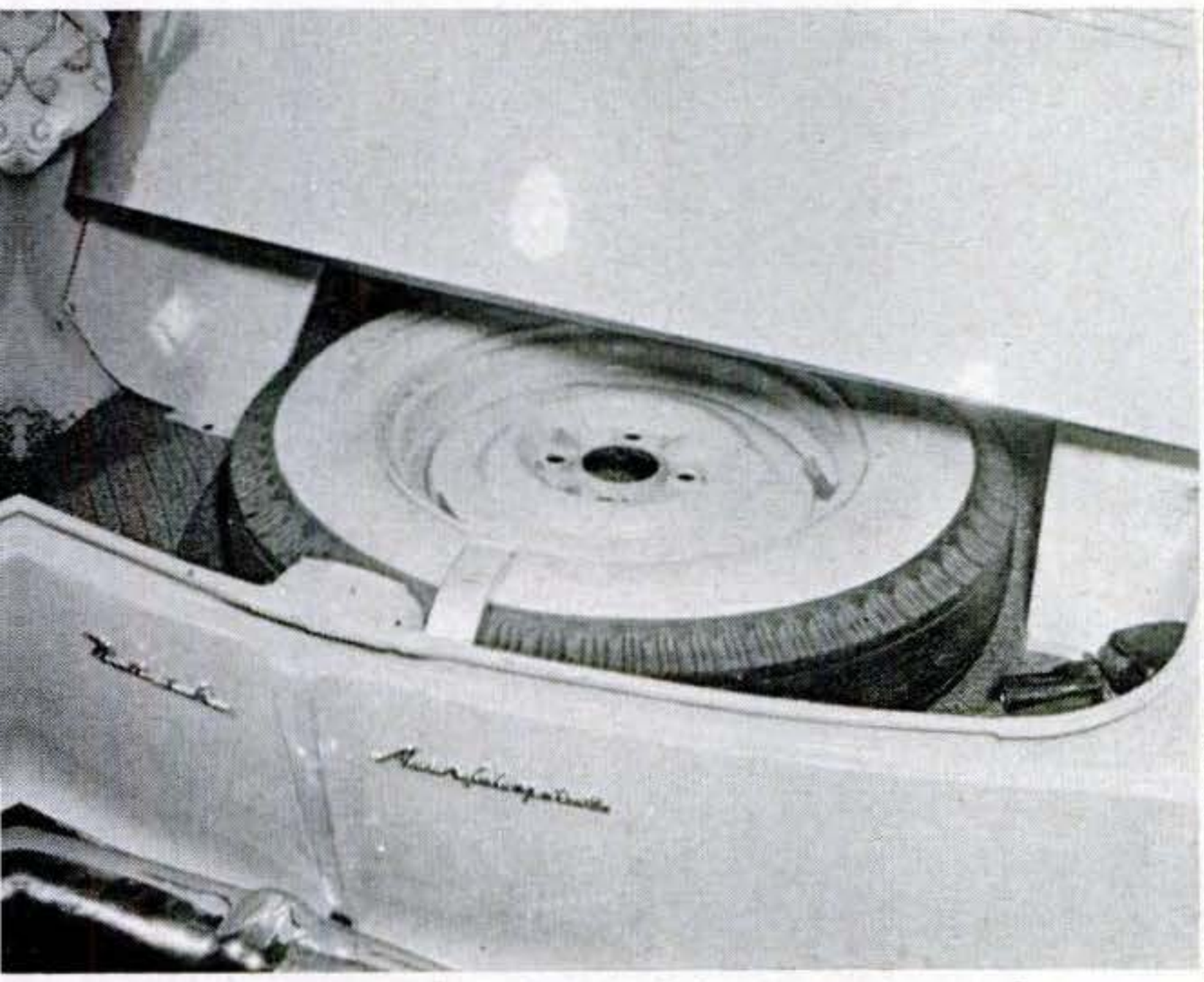


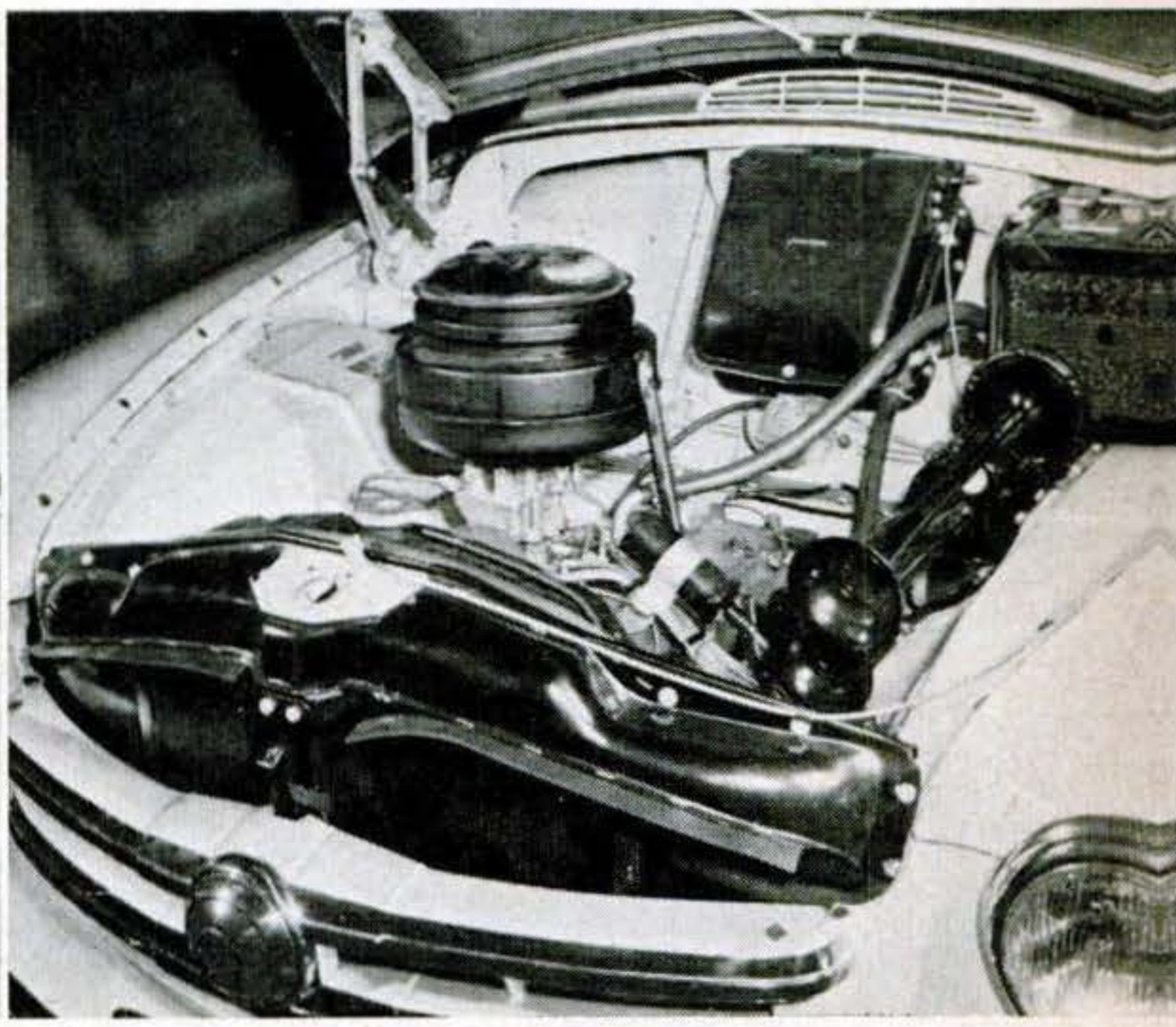
Nylon-covered steel cable threaded through pulleys just behind windshield pillars on each of two body rails pull top into place and retract it. Fabric folds neatly as top goes down.



Cables drawing top into place and retracting it are pulled around drum spotted behind compartment into which top drops. Drum is geared to small motor switched by a control on dash.



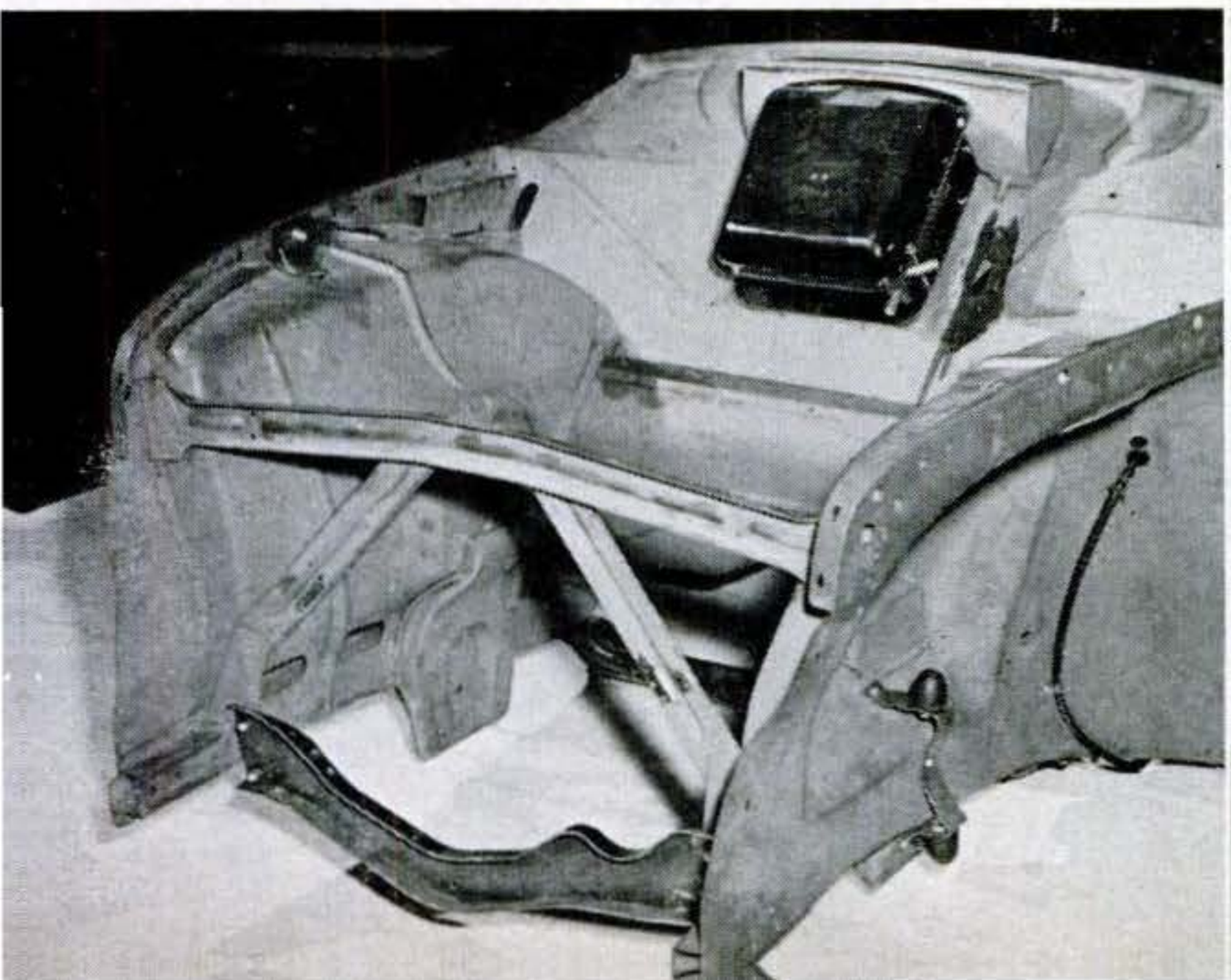
Rambler has limited luggage space because spare wheel lies flat in middle and a well for storage of top intrudes into compartment. However, with top up, well itself can carry parcels.



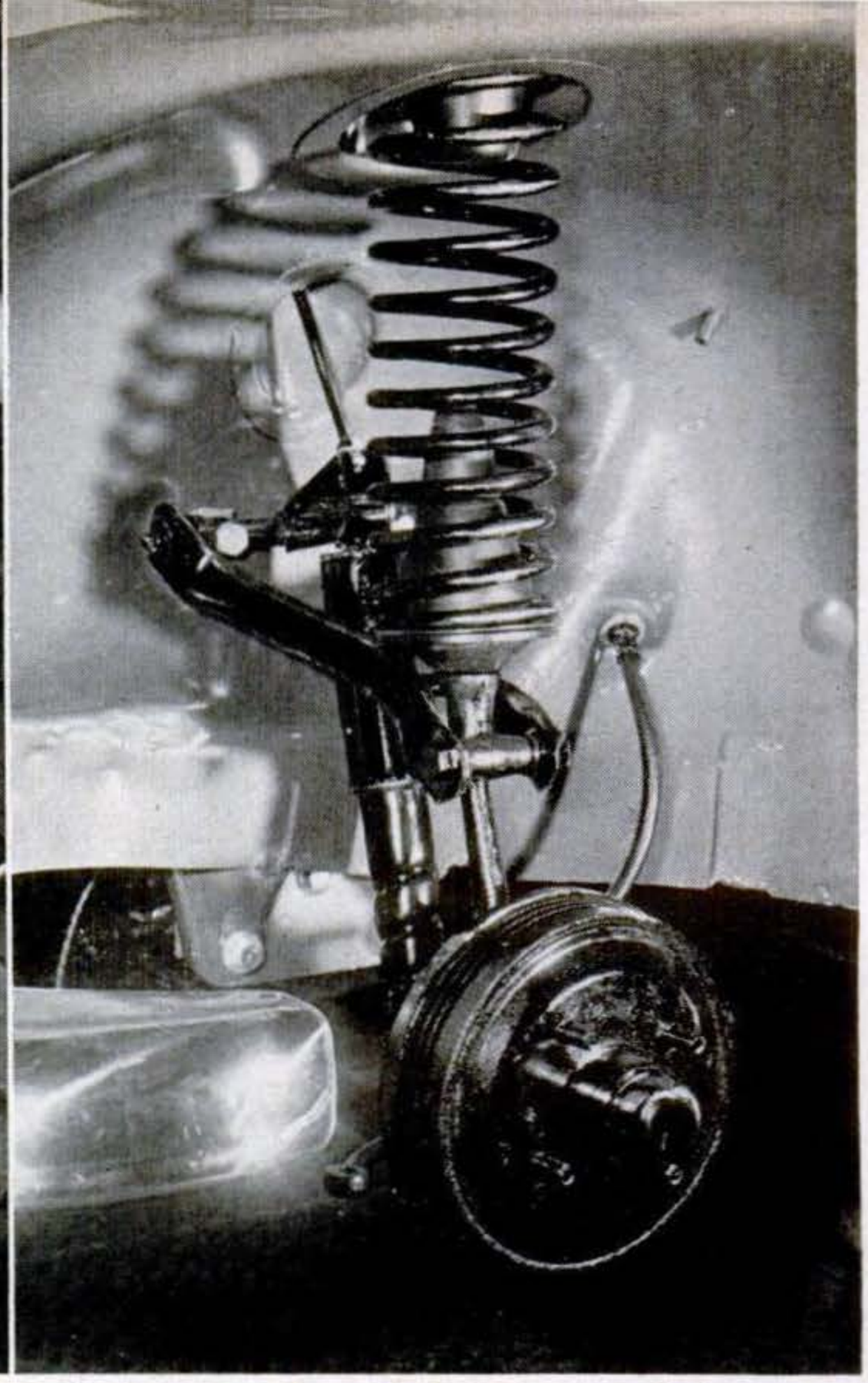
Shortening car required as compact an engine compartment as possible. Space allotted engine is only 29 in. long. Even width of fan belt was shaved to save a fraction of an inch.

Here's secret of unique front-suspension system: shaped steel panels are braced top and bottom to form a box to which upper and lower control-arm pivot bars, springs, shocks are held.

Several pounds of weight were saved in windows by using extruded aluminum frames bolted to body and doors. In conventional construction, at left, steel frame is integral with door.

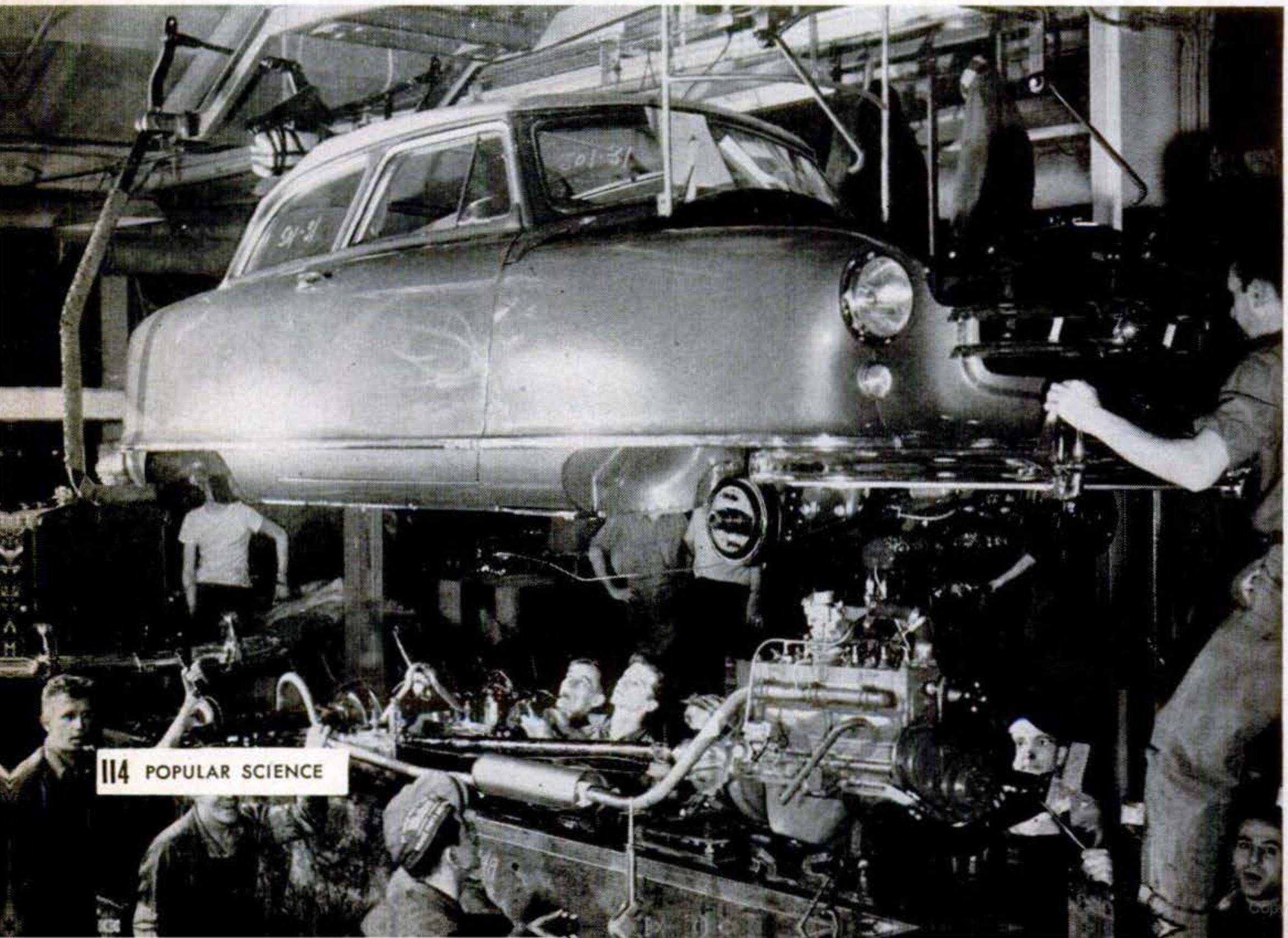


In this manufacturing photo suspension structures have been attached to car's skin forming front wheel well. Spring, being put in here, acts directly on front-wheel steering-knuckle support.



Spring, now installed, is in extended position. Arrangement permits softer, more flexible springs and lighter control arms due to less unsprung weight. Arms serve only for alignment.

"Unitized" body on production line is lowered onto rear axle, engine, exhaust line, prop shaft.



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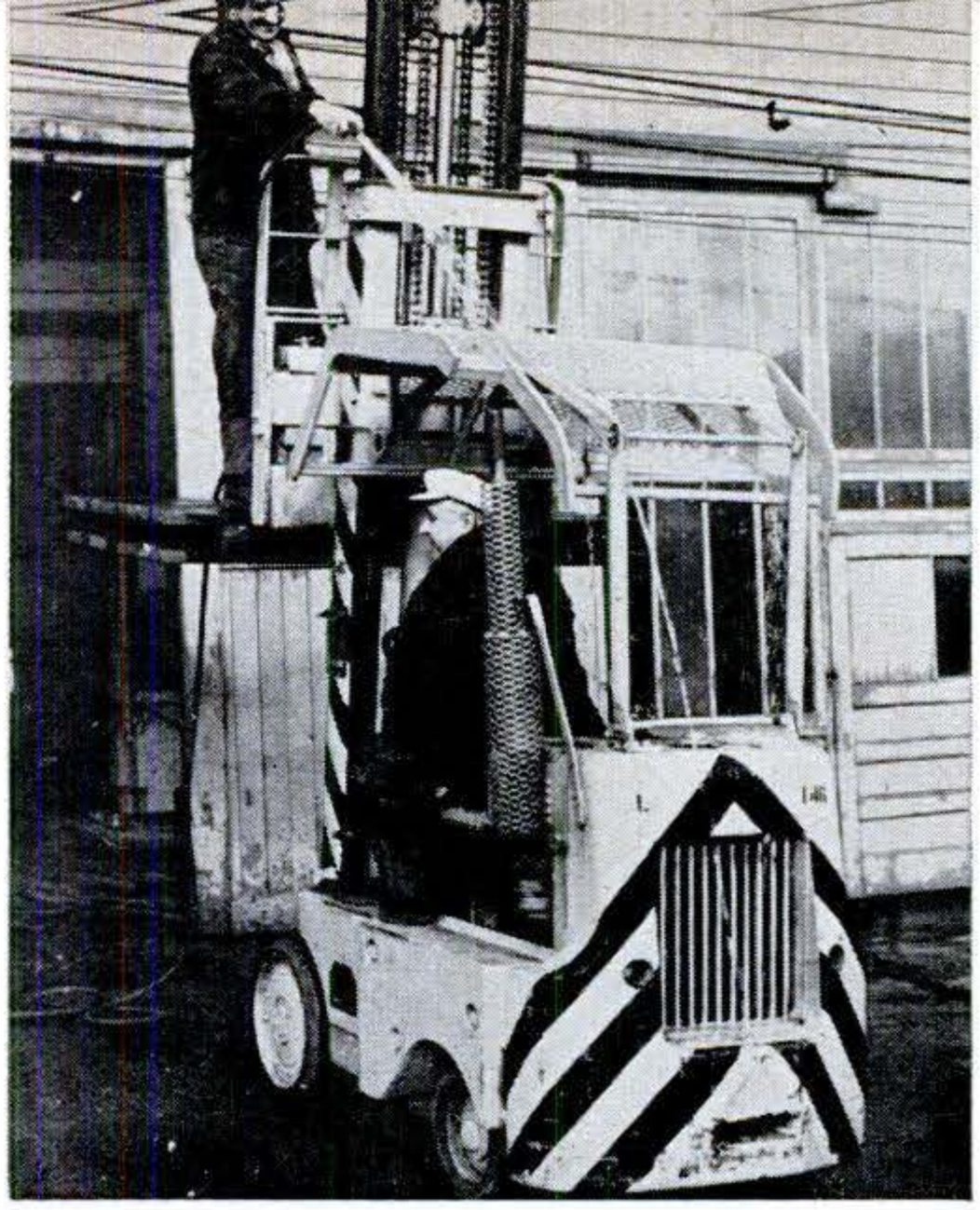
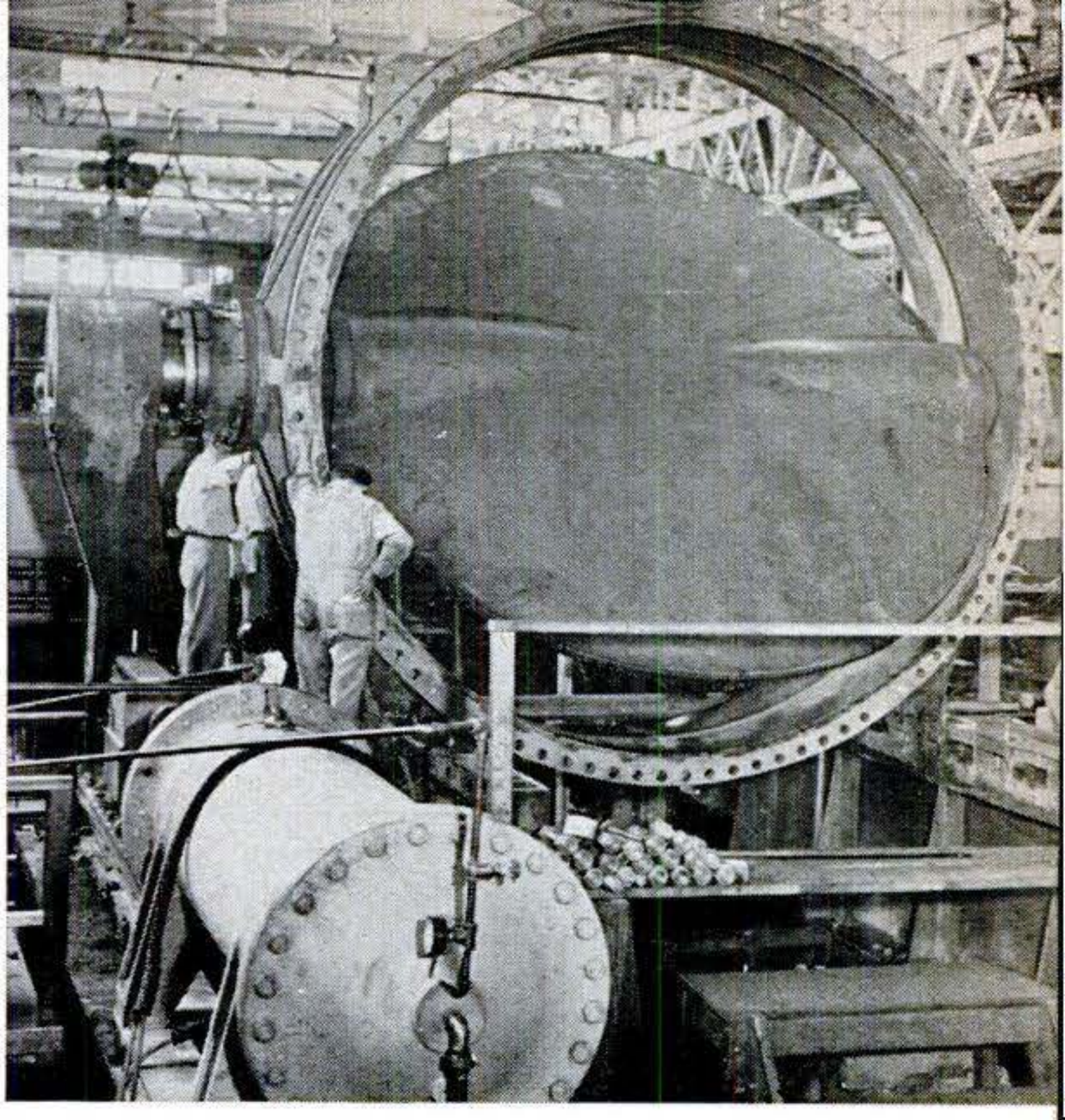


Fork-Lift Truck Gets Canopy

FORK-LIFT truck operators driving on the piers at the Army's Port of Embarkation, in Seattle, Wash., are now protected from rain and snow by a transparent, plastic weather shield attached to their trucks. The canopy, made of 1/16-in. Vinylite framed with plywood, fits into a metal safety guard mounted over the driver's head. Sloping downward at each end, the canopy shields the worker both front and back. In the photo above, a worker uses a hose to test the covering for leaks.



Giant Valves Hold Dam Water

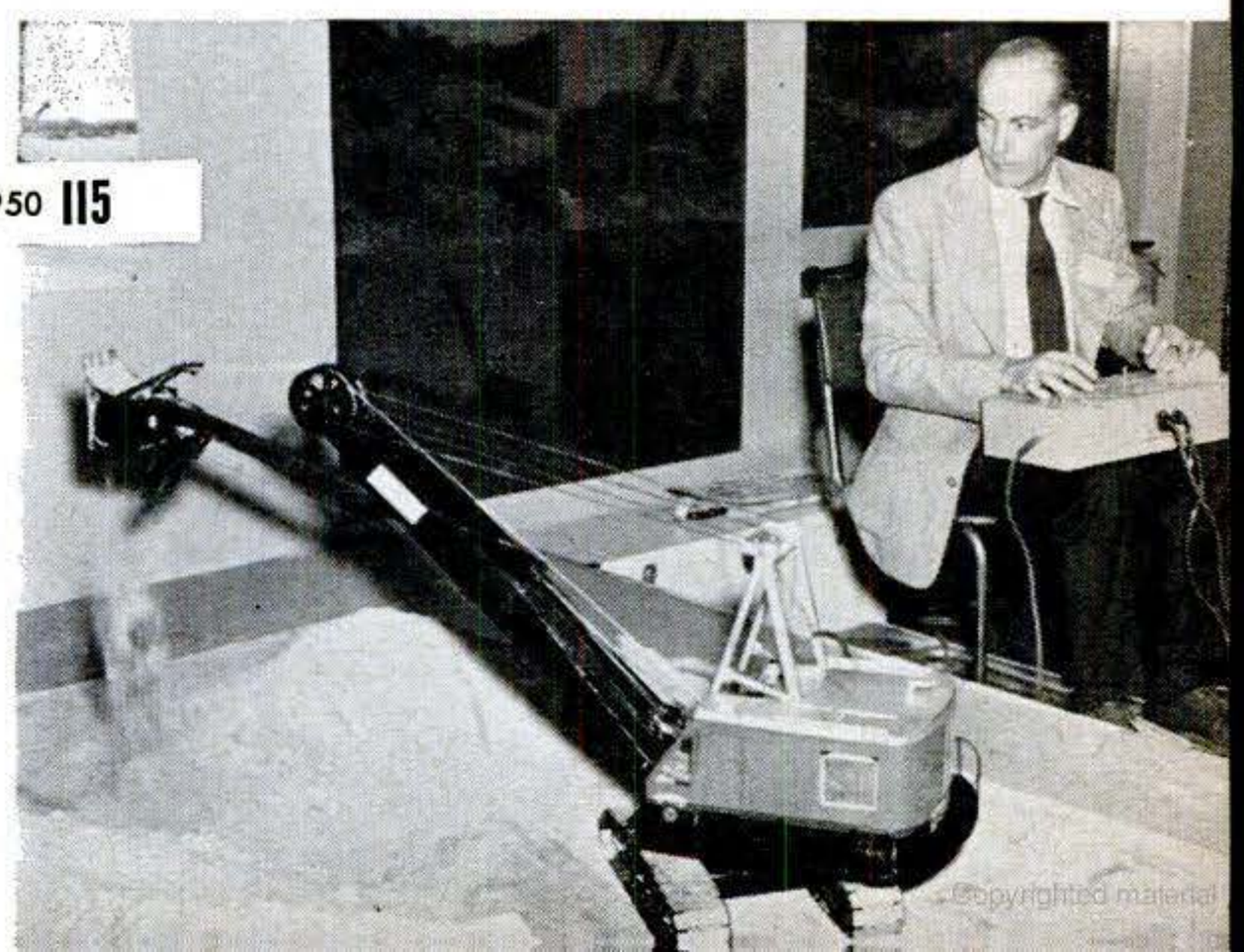
WHEN four of these huge butterfly valves open tunnel outlets of dams on Feather River, Calif., 5,400,000 gallons of water a minute will flow through them. Each valve will hold back water under pressure of 8,600 pounds a square foot, which, when released, will spin a 73,500-hp. generator to produce electricity at the Rock Creek and Cresta powerhouses of the Pacific Gas and Electric Co. In the photo above, Westinghouse engineers are testing the operating mechanism of one of the 50-ton wing-leaf valves.

Funnel Warms Plane Faster

PLANE-ENGINE warm-ups in winter now take only 20 minutes—less than half the time they used to require—thanks to a new metal heating funnel that fits snugly against the engine cowling. Shown in place on the DC-3 below, the funnel is connected to a heating truck by a flexible hose. Hot air blown from the truck warms the engine. The funnel has slots that fit around the base of the prop's blades, preventing loss of heat.

Tiny Shovel Digs and Dumps

THE miniature power shovel below not only is an exact 1 in. to 1 ft. model of its big brother, made by the Link-Belt Speeder Co., but duplicates all its loading, swing, and dumping movements. Operated by remote control from the box in the man's lap, the all-metal midget shovel is powered by four 1/20-hp., 110-volt electric motors. C. D. Dodgen, of Houston, Tex., spent six months and almost $1,000 building it.



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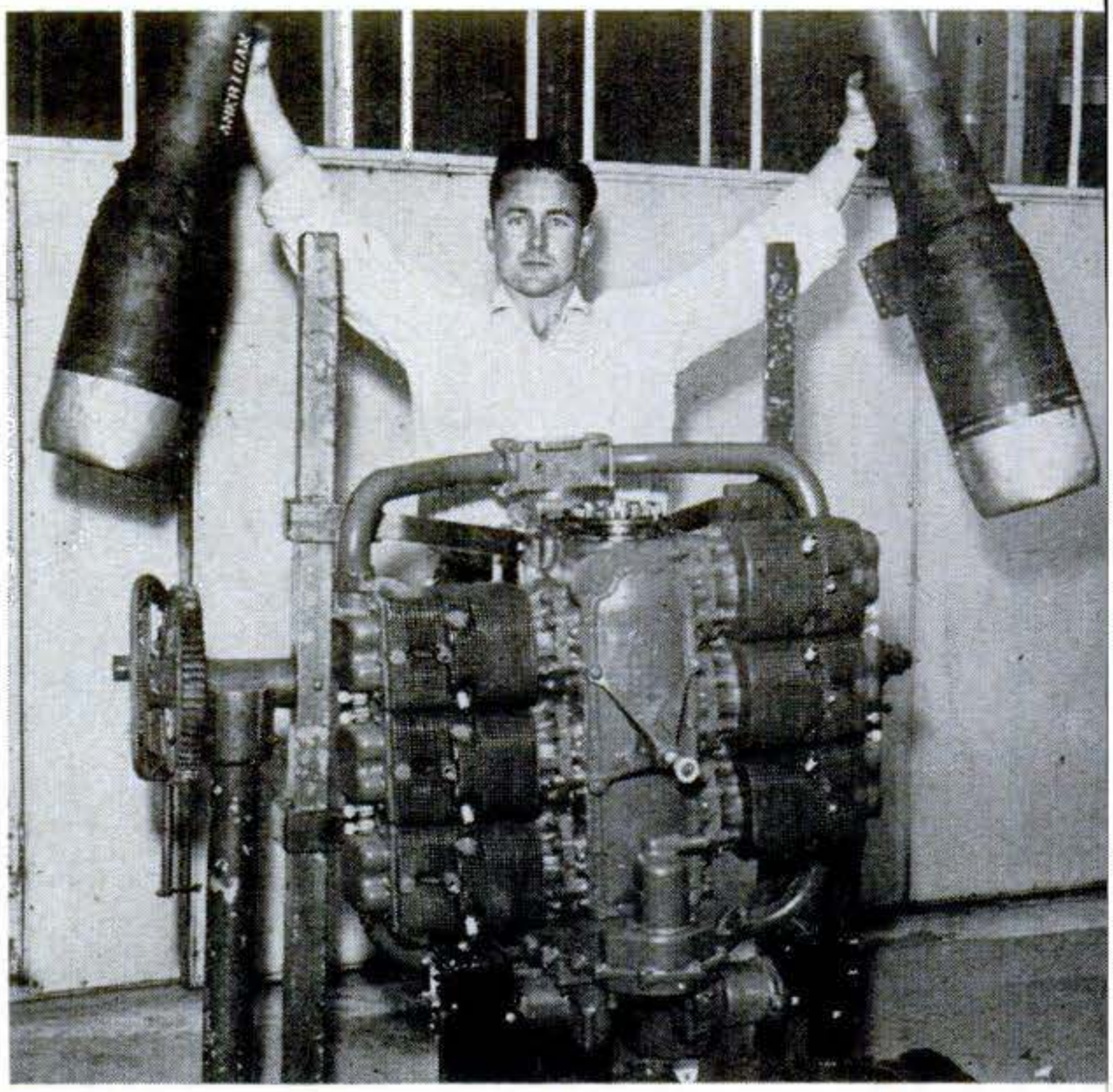
"Top Sergeant" takes off near Los Angeles in first public appearance. Tapered tubes on blade tips are pulse-jet engines that spin the rotor. Craft weighs 900 lb., can carry 400 lb.

Pulse Jets On Blade Tips Lift 'Copter

THIS odd-looking flying machine is described by its designer as "the world's simplest helicopter." All its power comes from a pair of slender pulse-jet engines mounted on the rotor tips. They weigh less than 25 pounds apiece and have only one moving part—which can be replaced by a mechanic in five minutes.

The experimental craft, called the "Top Sergeant," was built for the Air Force by the American Helicopter Co., of Manhattan Beach, Calif. The company says its lightweight engines and absence of drive shafts and gears enable the ship to lift twice the payload of a conventional helicopter of the same size on short hops. Chief disadvantage is high fuel consumption: about 80 gallons an hour.



Top Sergeant's two pulse jets are compared, above, with 300-lb. piston engine for conventional 'copter of same size. The jets each develop thrust equivalent to 40 horsepower.

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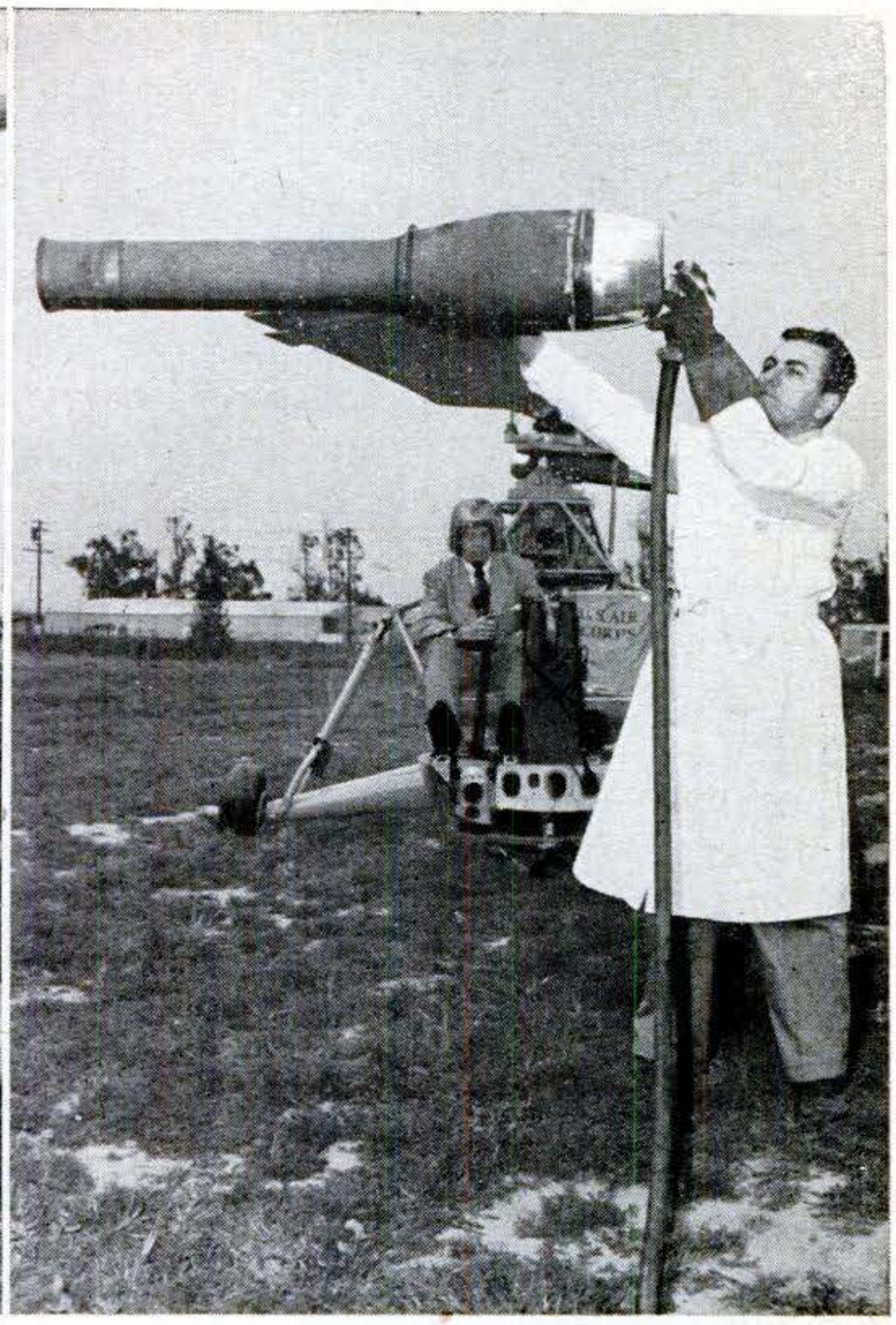
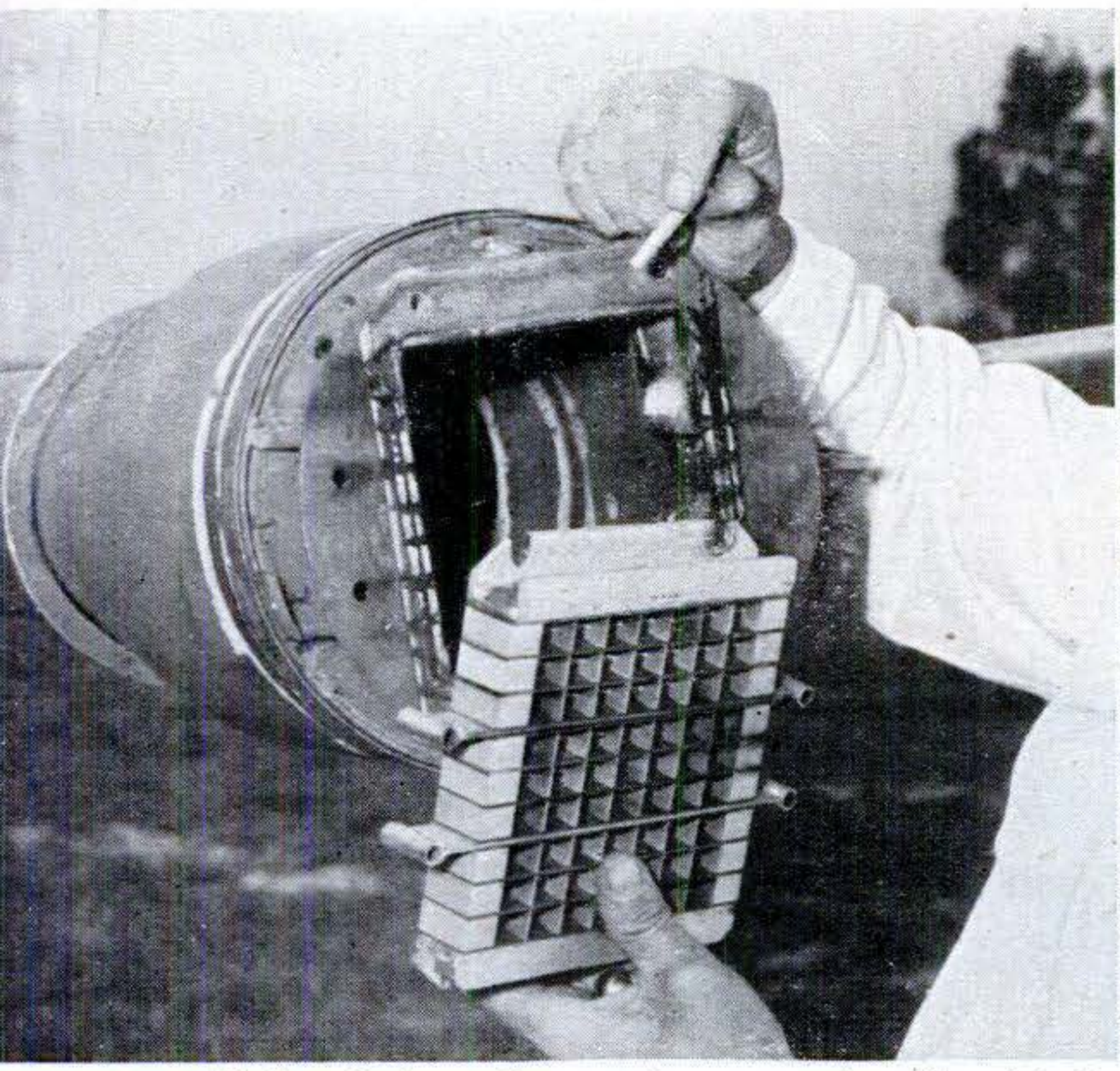
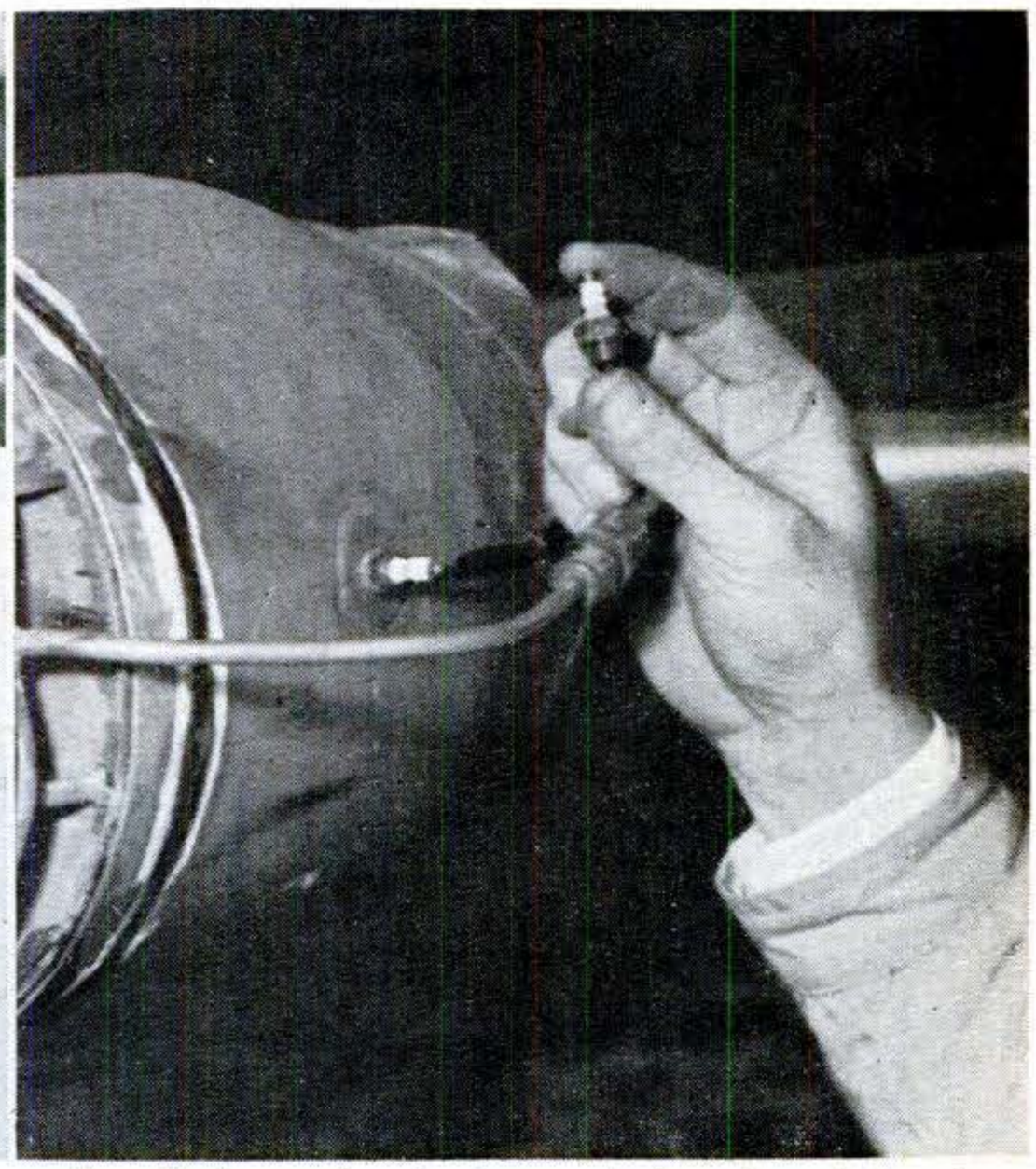
Test pilot Al Bayer gives controls of experimental helicopter a last-minute check. Pumps in front of him feed fuel from fuselage tank to engines through the rotor head and blades.



For starting, one engine is primed by shooting compressed air into fuel spray. Mixture is fired by spark plug. Whirling of rotor then forces necessary air stream through other engine.



Pulse jet's only moving part is valve block that one man can replace in five minutes with two wrenches and a screwdriver. Shutter valves let air in, then close during combustion.



Sparkplug, shown in man's hand and in place on engine, is used only for starting. Ignition is then cut off, and jet continues to fire intermittently after each puff of incoming air.

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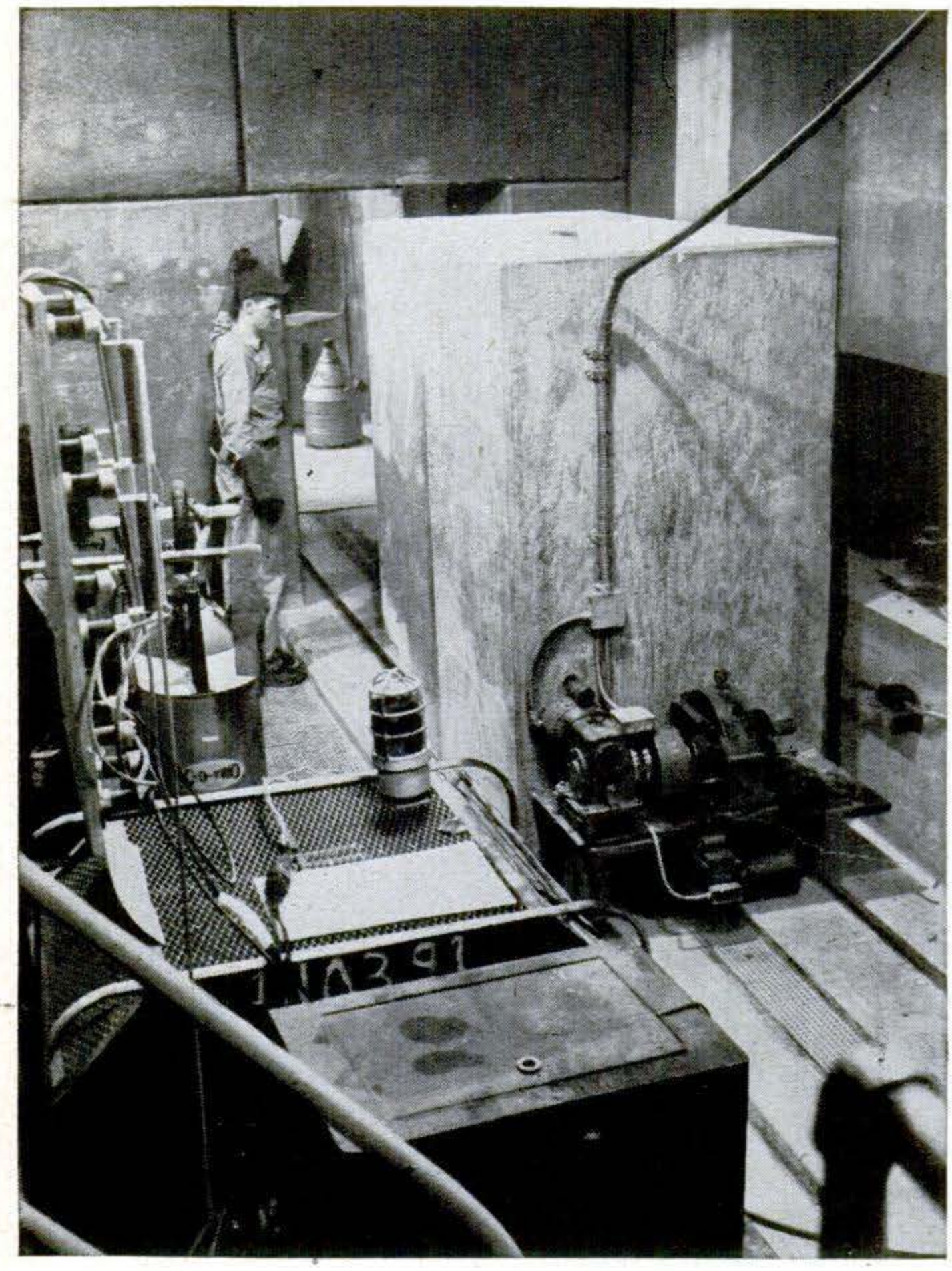
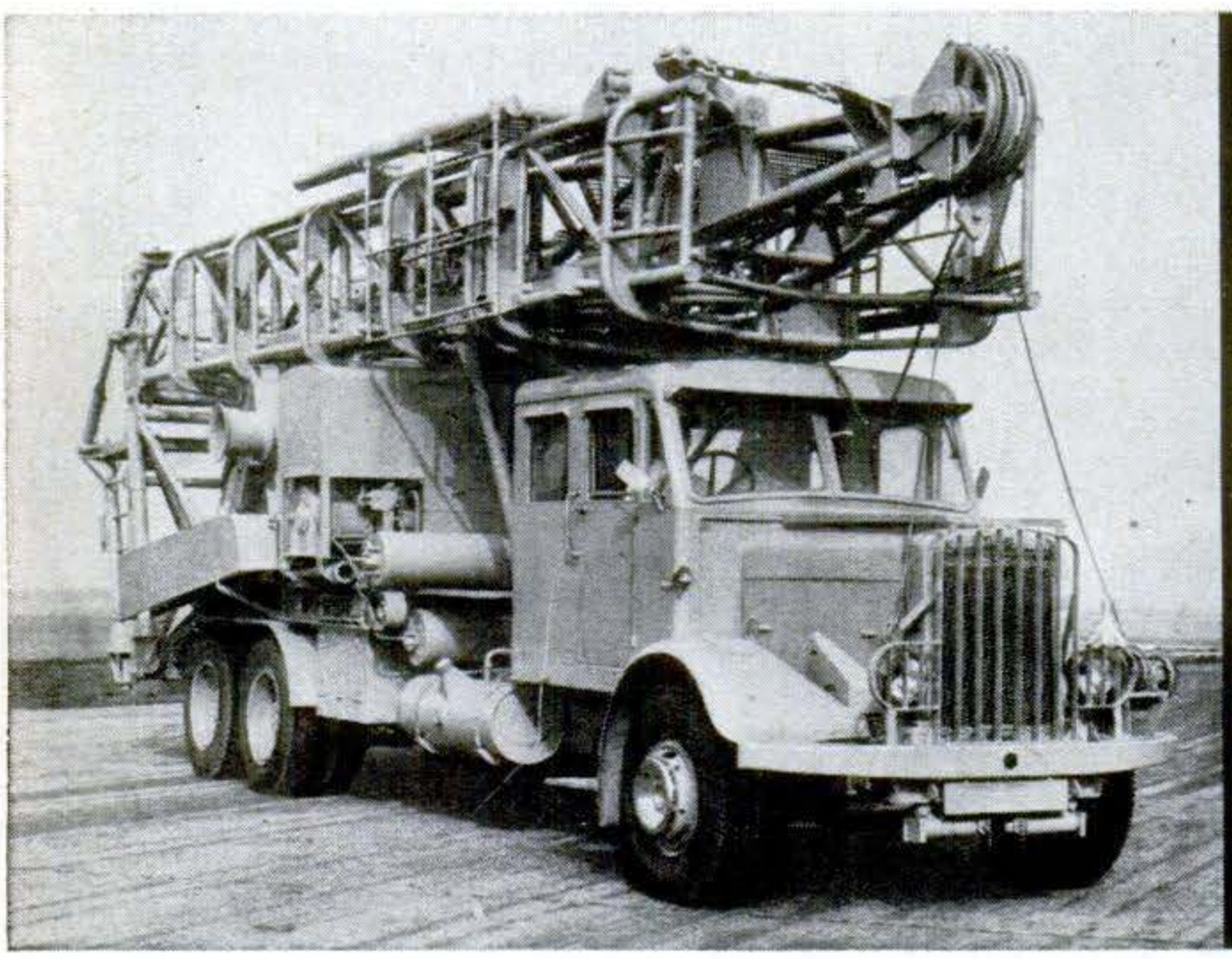


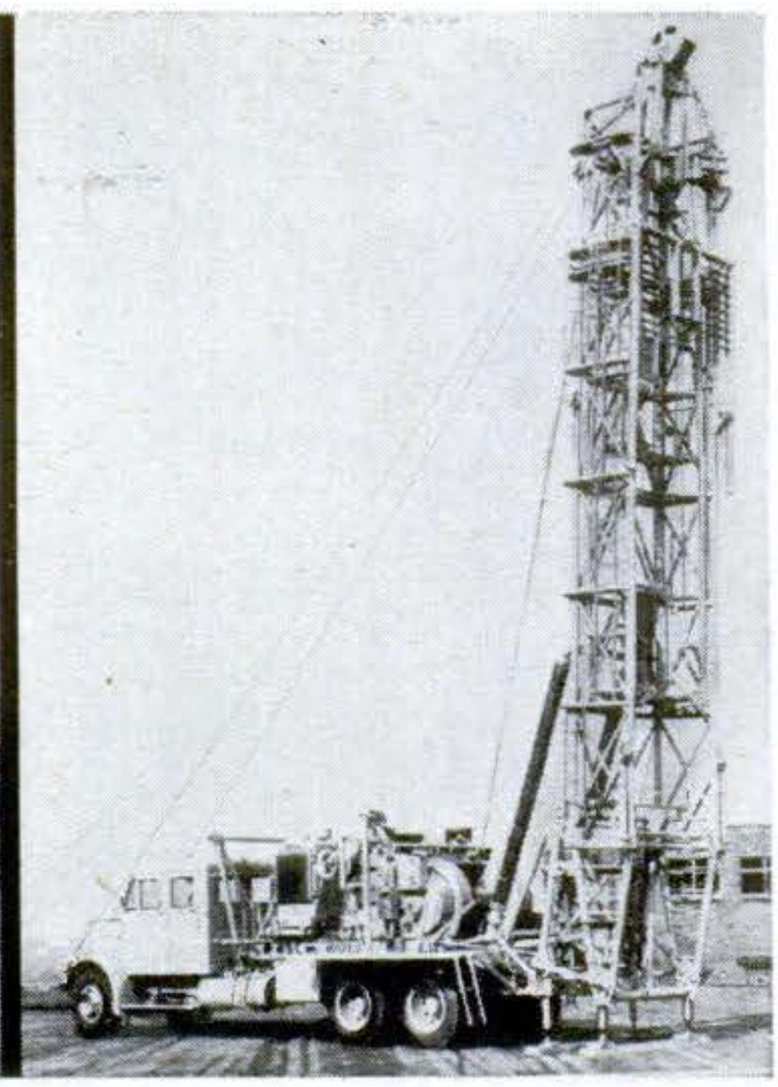
Cyclotron Door Weighs 15 Tons

THIS solid block of concrete, weighing 30,000 lb., is one of the two doors to Columbia University's newly built atom-smasher at Nevis, Irvington, N. Y. Mounted on tracks and propelled by attached motors, the doors are part of 27,000 cu. ft. of reinforced-concrete shielding that provides protection against the machine's 385,000,000 electron volts.

Costing $2,400,000, the world's most powerful synchro-cyclotron now in operation was developed in cooperation with the Office of Naval Research and the Atomic Energy Commission. The terrific impact produced by the high-energy protons (hydrogen nuclei) accelerated by the cyclotron has already resulted in the artificial creation of mesons. They are suspected of being "atomic glue" that holds together the nucleus of an atom.

Mobile Oil Derrick Can Be Set Up in a Hurry





THIS mobile oil derrick can move quickly from one well to another for fast servicing jobs, saving the time and cost of setting up permanent structures. Made by the Woodfield Hoist Co., of Rochester, England, it can be used for both hoisting and drilling.

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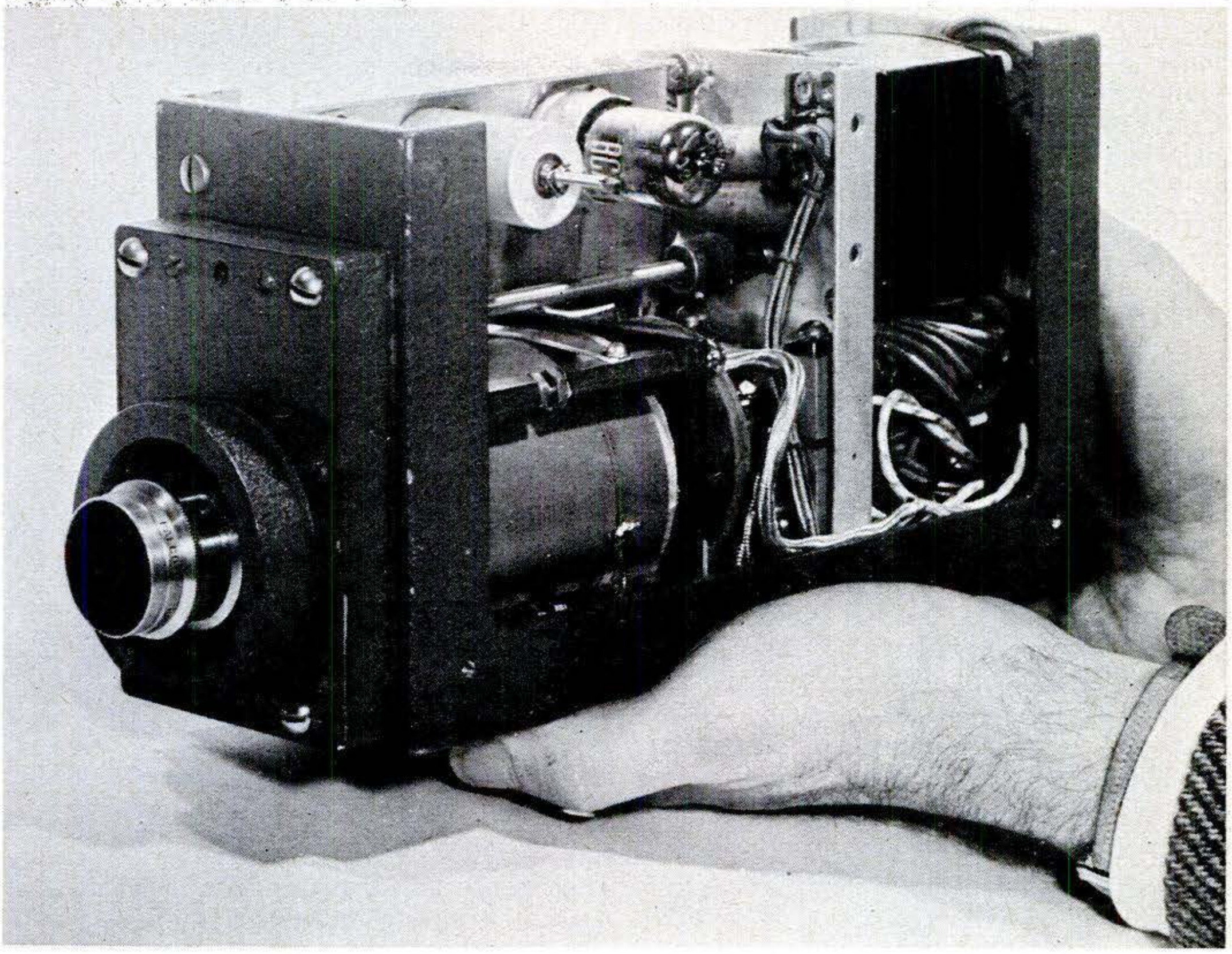

New camera for industrial and educational video fits in the hand. It weighs only eight pounds.

Miniature TV Camera Keeps Tabs for Industry

The "Vidicon" image tube now provides an extendable, expendable eye for schools, labs, and factories.

By Martin Mann

PS Photos by Hubert Luckett

TELEVISION, already the lustiest brat in show business, soon may become just as important to industry and education. A new kind of camera "eye" can do it. Called the Vidicon, this RCA image tube is the basis for the lightest, cheapest, simplest TV camera made.

In factories and laboratories, it can watch from a distance, saving lives, time, and money. In schools, this same new eye may simplify teaching, enabling large classes to peek over the teacher's shoulder.

The camera is so small and light—eight pounds—that it can be set up almost anywhere. It can slide inside a cannon barrel to observe the bore finish, hang under a car to watch springs in action, go down an oil well to inspect the casing, or fit on a teacher's desk or workbench to pick up the details of an intricate demonstration.

It can go where no human eye dares go: inside concrete cells to watch rocket engines being tested or dangerously radioactive atomic materials being processed.

The cost of the camera and monitor-receiver is low by comparison with standard studio equipment. Banks might want

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a setup for quick comparison of check signatures; prisons could use several cameras to guard walls and cell blocks; hospitals might hang a camera over operating tables, giving many doctors a surgeon's close-up view.

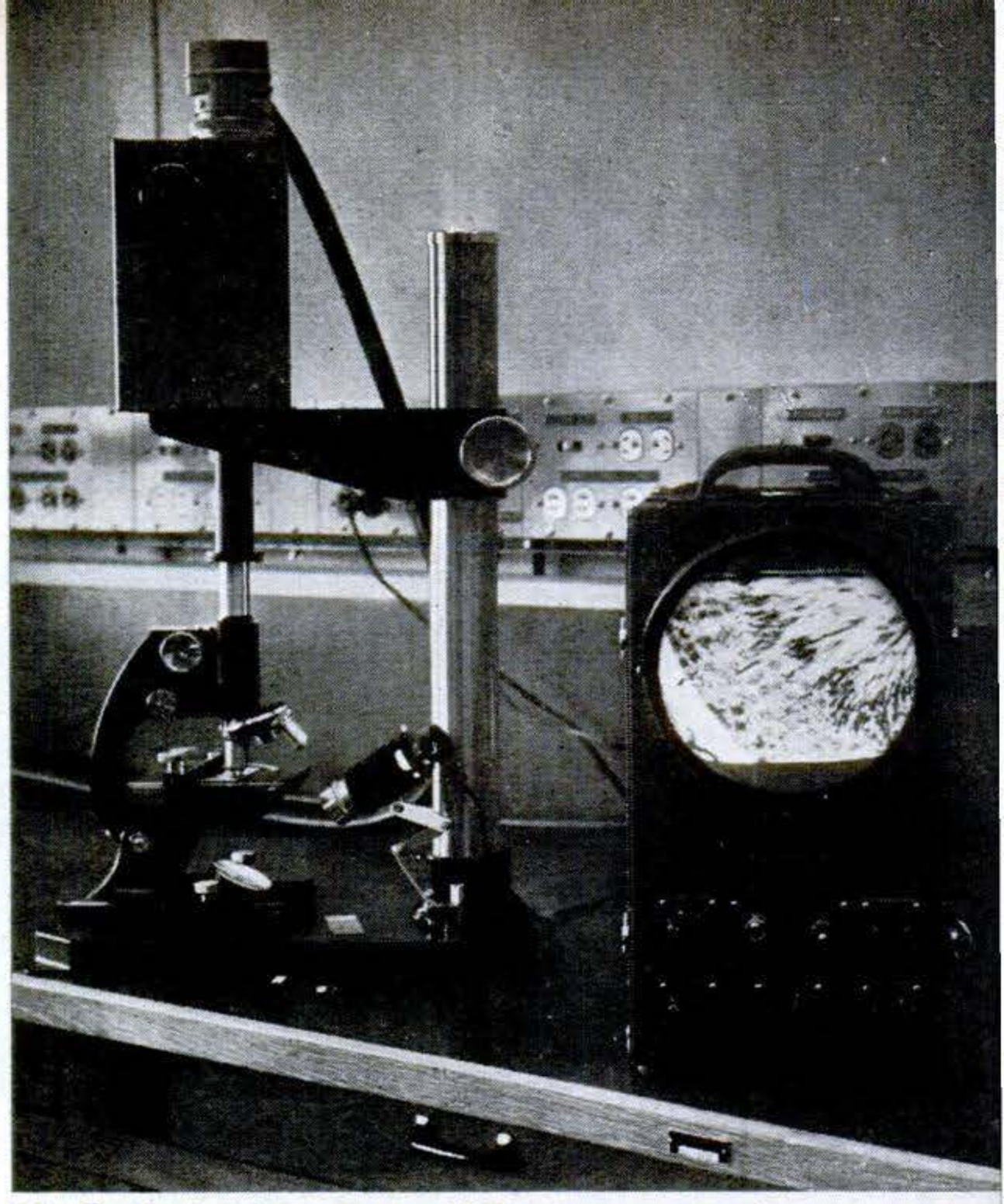
The camera itself includes only the barest essentials. It has a lens—a 16-mm.-movie type—a Vidicon image tube, two vacuum tubes, and a motor to focus the lens.

The monitor contains the synchronizing generator, normally included inside a studio TV camera, plus the power supply, amplifying circuits, and seven-inch viewing screen. All told, it has 44 vacuum tubes—about as many as you might expect in a rather elaborate home receiver.

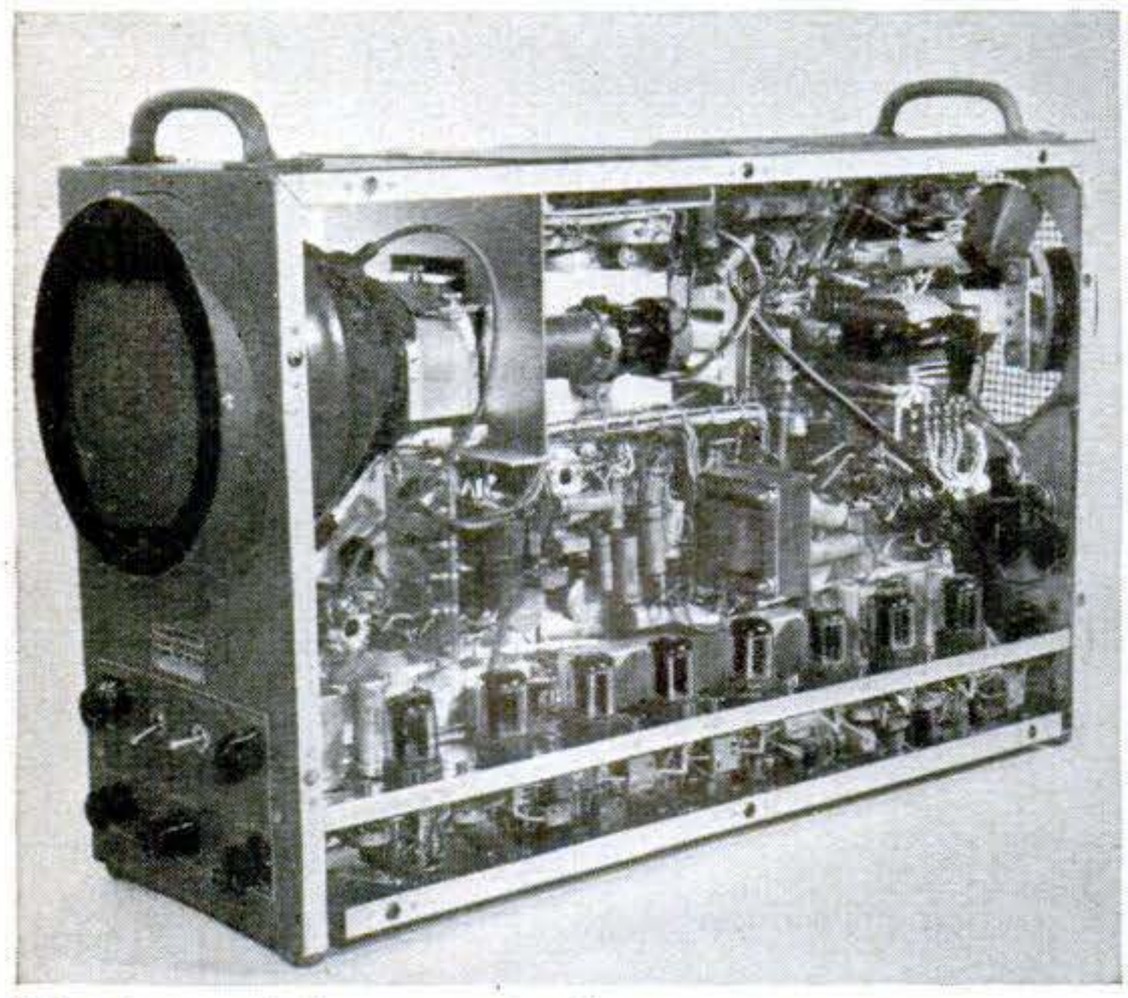
It is the Vidicon image tube that makes such simplicity possible. The Vidicon is a slim glass cylinder, smaller than a flashlight and only one-tenth the size of the image-orthicon tube used in studio work.

The big difference between the Vidicon and other camera tubes—and also the reason it can be so small—is its use of the principle of photoconductivity. The light-sensitive target is a material, such as selenium, that changes from an electrical insulator to a conductor when struck by light.

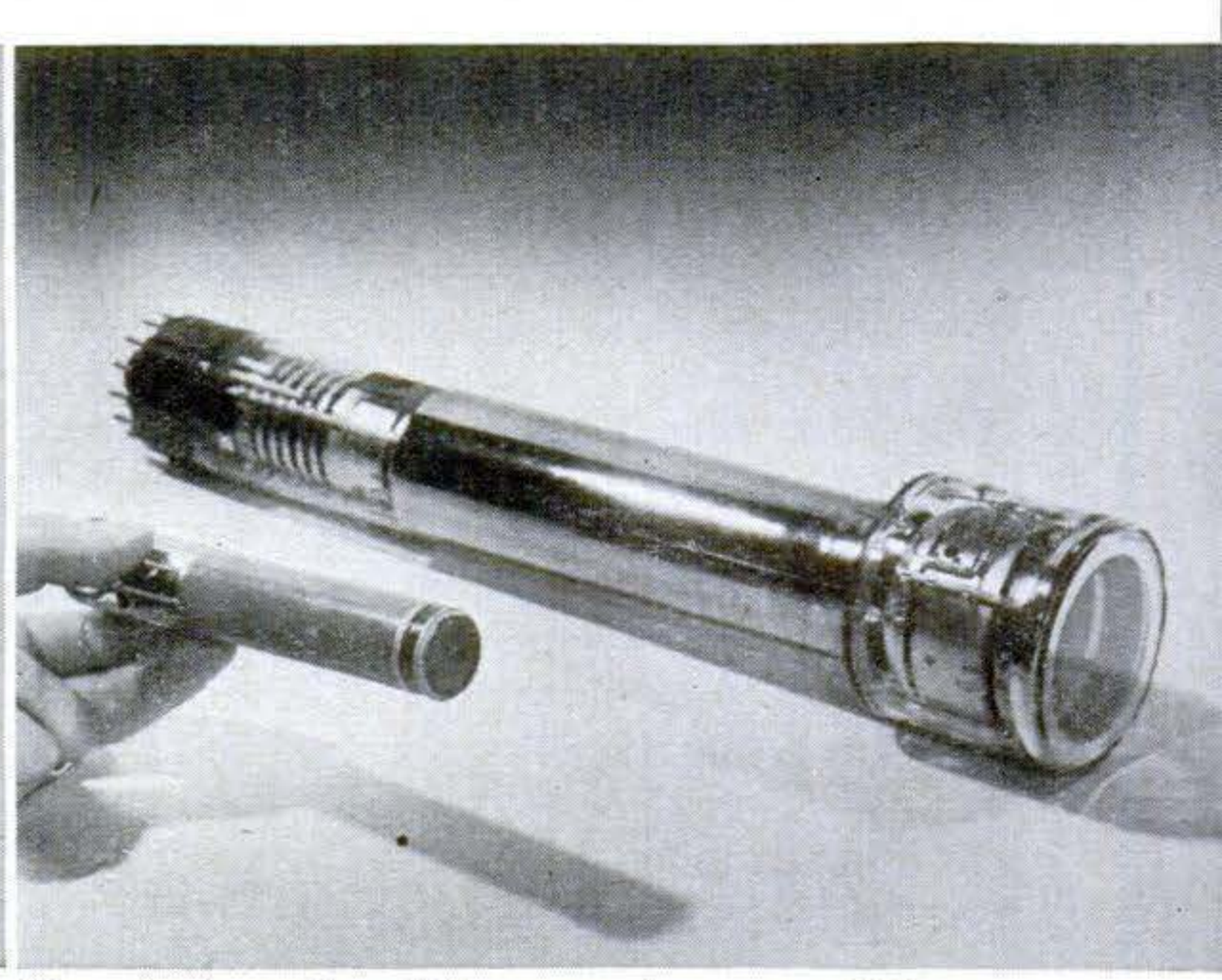
In the Vidicon, this photoconductive target serves the same purpose as the film in a photographic camera. The image of the scene being televised is focused on it by the lens. Wherever there are light areas, the target will conduct electricity. Since one face of the target is kept at a higher voltage than the other, charge will flow through those light-struck areas to the low voltage face. The charge stays there until neutralized by the scanning electron beam. When the charge is neutralized, a signal is created in the signal plate lead, which is connected to the high-voltage face of the target. This signal then goes to the monitor,



Hooked to microscope, Vidicon camera relays image of rat tissue. Students in different classrooms could all see same thing at once, while microscope and camera could be someplace else.



Monitor with seven-inch viewing screen is other half of industrial TV system. It can be as much as 500 feet from camera. Other receivers still farther away can be connected to it.



Size isn't only difference between Vidicon camera tube (left) and image orthicon (right) used in TV studios. Vidicon is cheaper, more simply built, and works on different principle.

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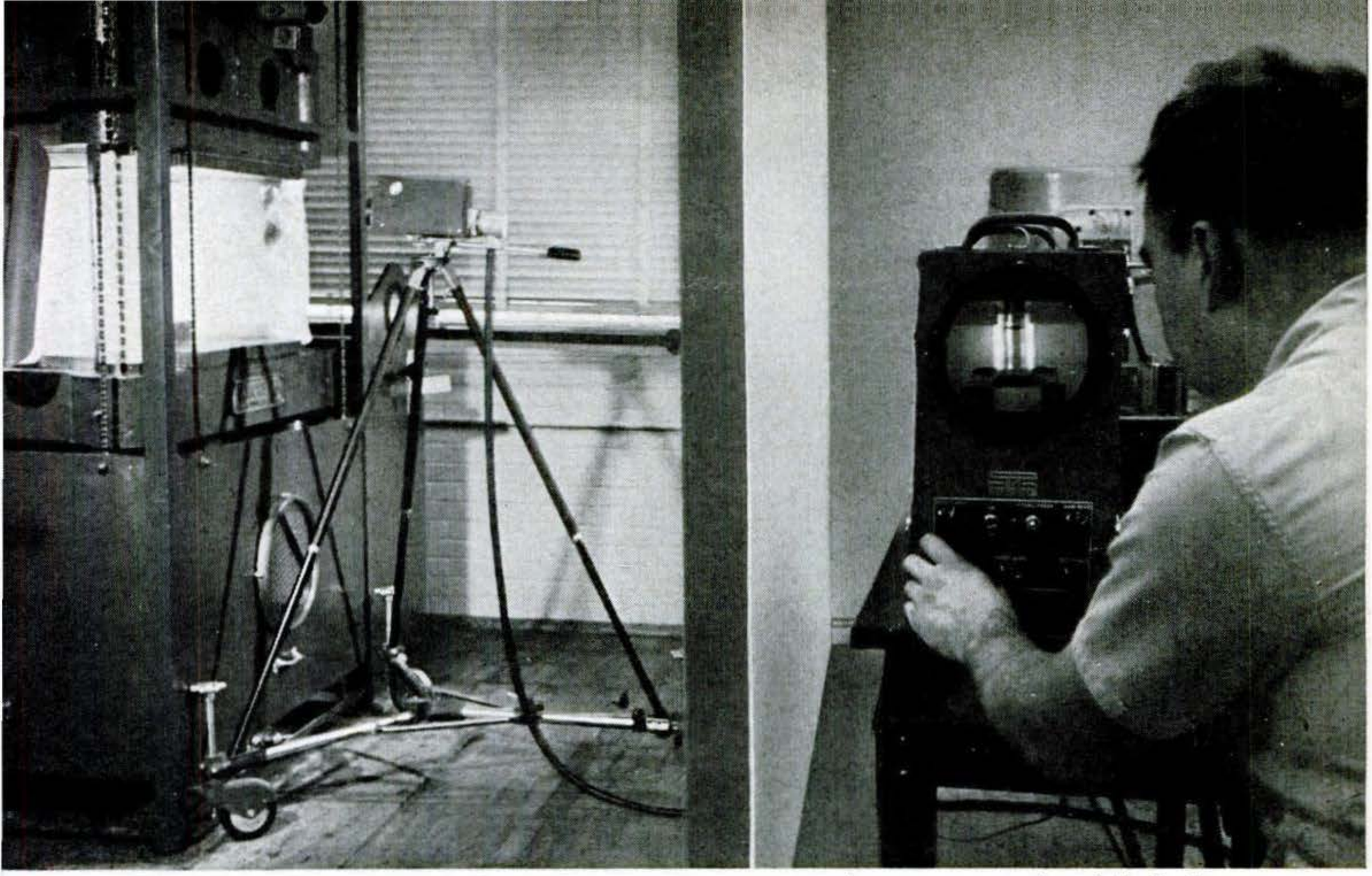


Watching dangerous industrial operations may be important use for new TV system. In demonstration photo above, camera is set up in front of big press. Operator, behind safety wall, controls press remotely while looking at image of dies and work on monitor screen. Similar television arrangement could be used for testing rocket engines or handling atomic materials.

where it recreates the light and dark image.

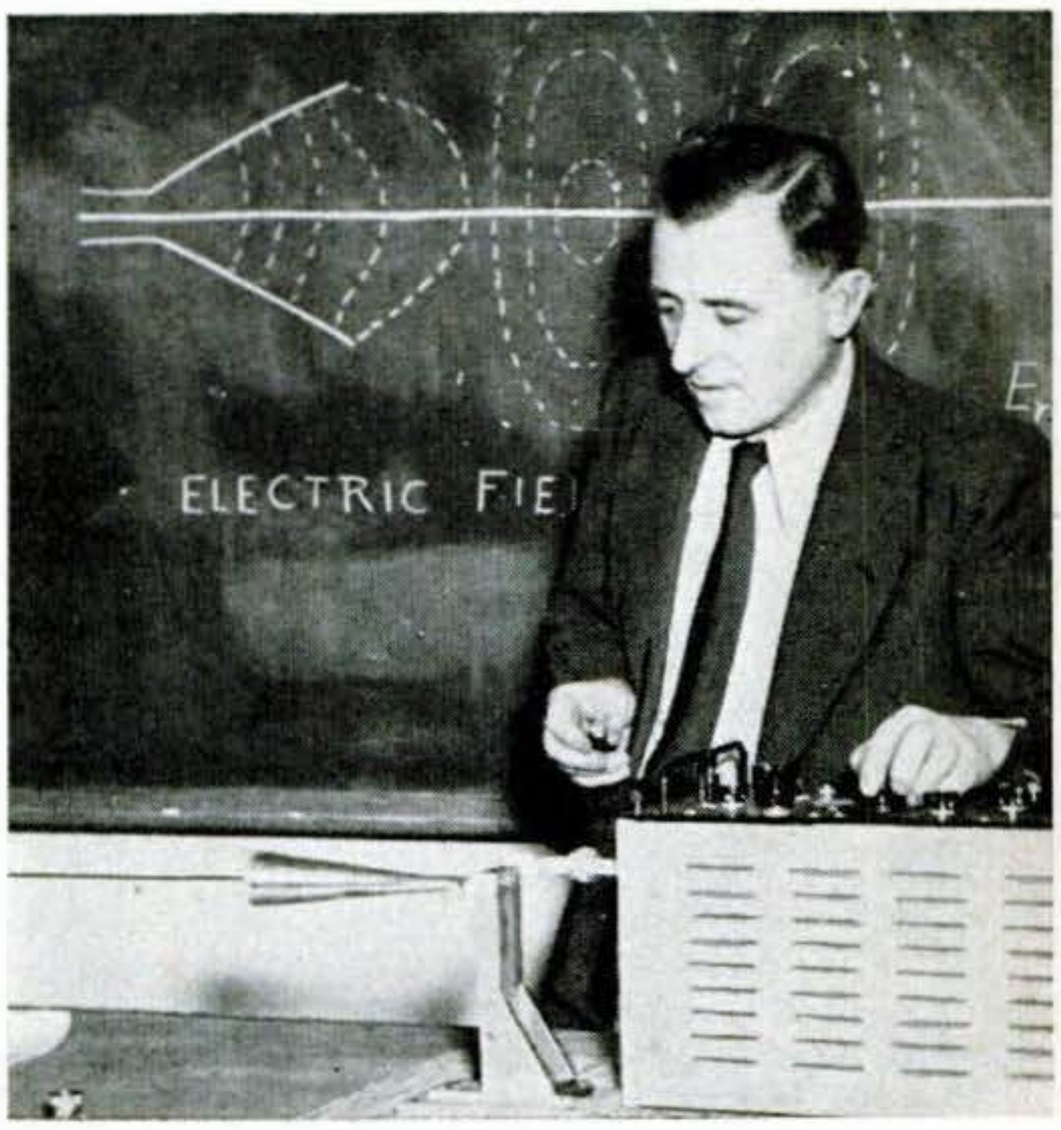
The Vidicon can see in much dimmer light than a studio-camera image tube can, but it can't see as clearly. For this reason, it cannot be used for television broadcasting over the air. When it is connected to the receiver by coaxial cable, however, it produces a picture just as good as seen on most home TV sets. And cable rather than broadcasting would be used anyway.

Eventually, RCA hopes to make the Vidicon as sharp as the image orthicons. Then telecasters will have a real candid camera, able to go and shoot almost anywhere. END

"G-String" May Replace Coaxial Cable For TV

THANKS to a simple strand of wire, you may someday be able to pick up your phone in your home town, call a friend in another state, and see him while you talk. And he would both see and hear you. The secret is in a special insulation system and funnel-shaped terminals that allow the wire to perform functions hitherto limited to costly and complicated coaxial cables. The Army Signal Corps, which developed it, calls it the "G-string," from the initials of the inventor, Dr. Georg Goubau.

One immediate use might be as a cheap method of piping TV programs directly into city homes. And it may be possible to crisscross the country inexpensively, extending TV networks into areas now inaccessible. Among military uses, simpler radar and communications are expected.



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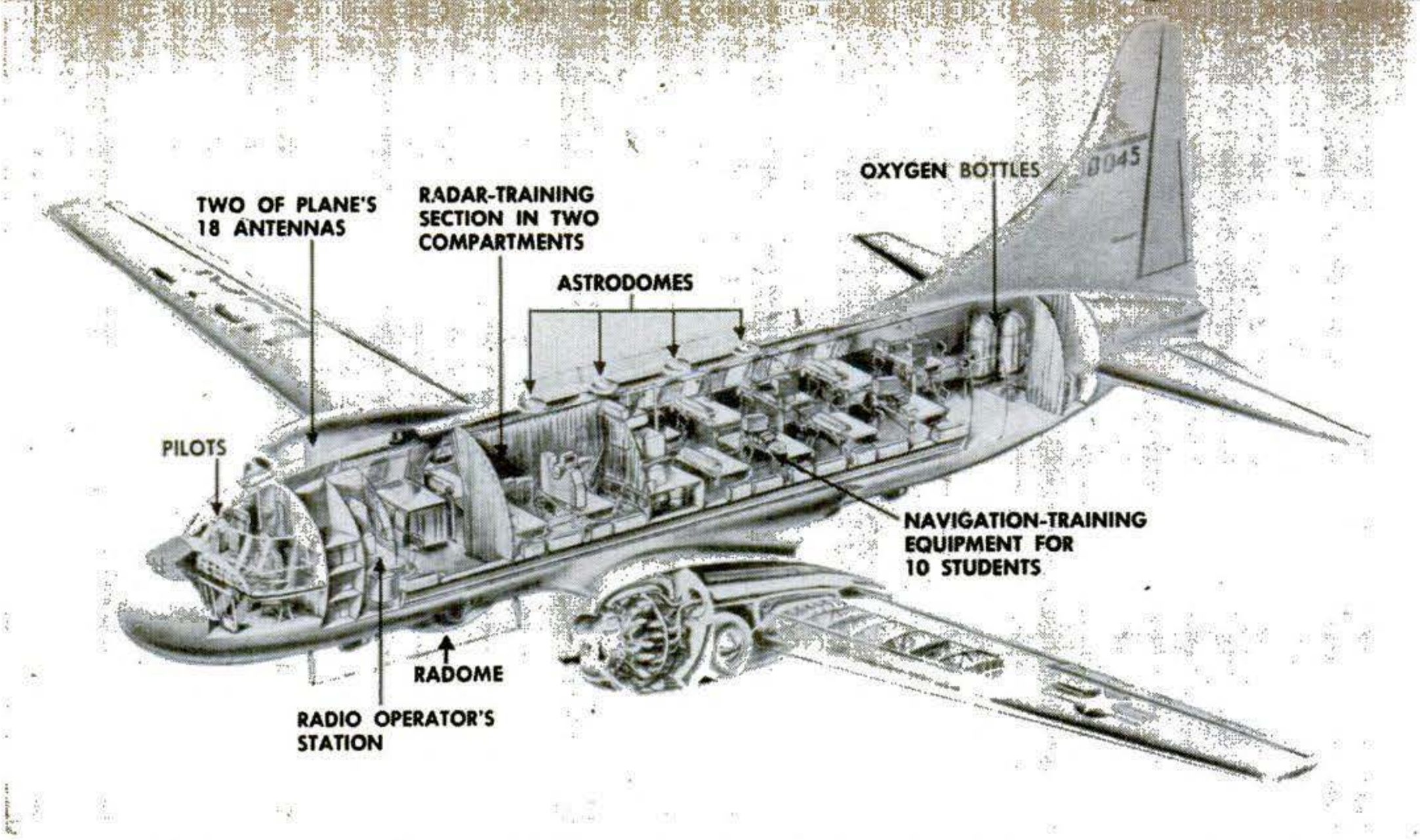
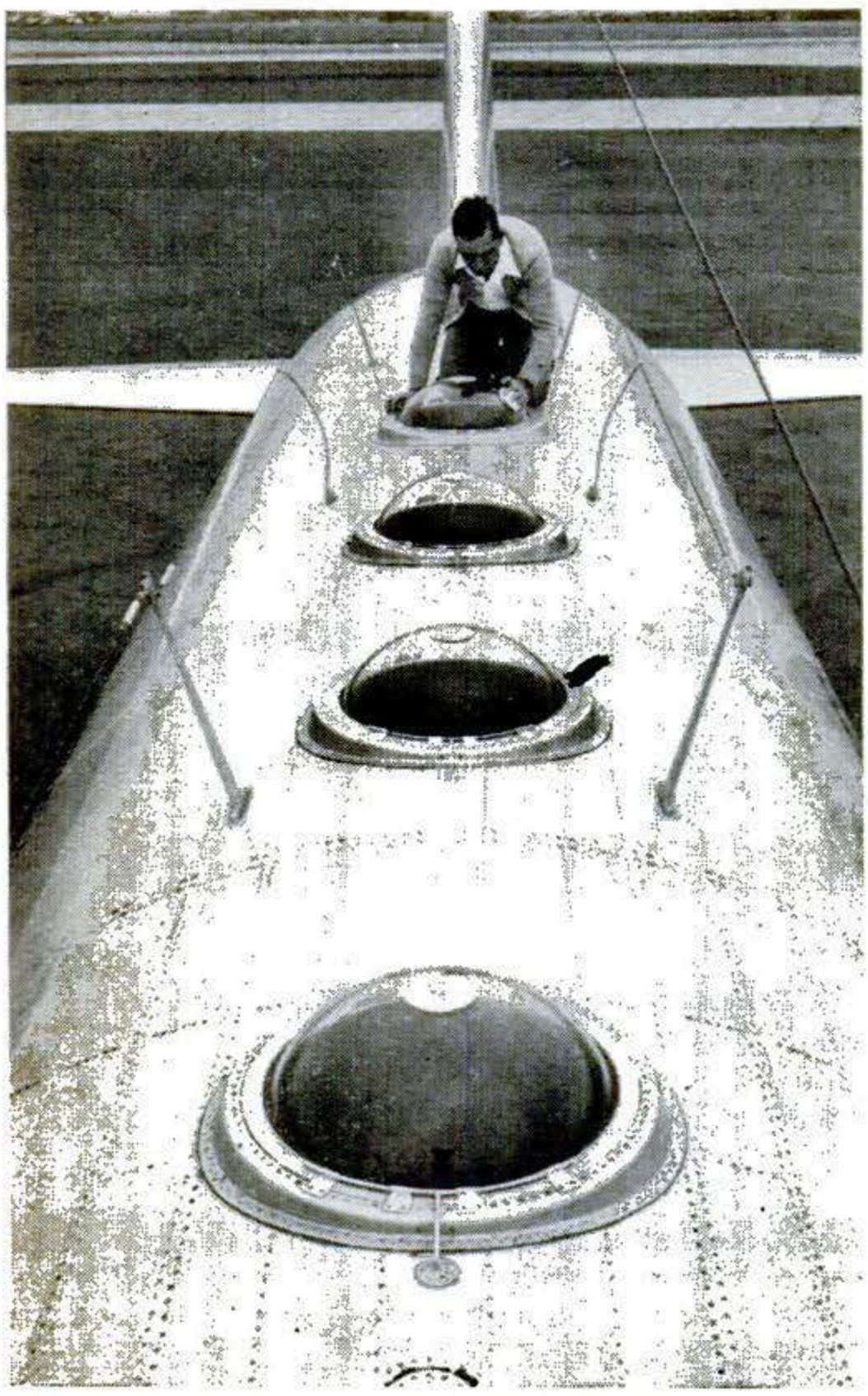


Classroom in the clouds, the new Air Force T-29, is a converted 40-passenger Convair-Liner.

Flying Classroom Trains Navigators



These astrodomes atop the fuselage enable four student navigators at a time to shoot the sun and stars to fix position of plane in flight. Special antennas are seen at the sides of domes.

NAVIGATORS must be trained in flight with the actual instruments used on a long-range mission. But one student in one navigation trainer is a slow and expensive way to do it. That's why the Air Force has ordered 36 of these flying schoolhouses. Each 300-m.p.h. plane carries instruments for individual training of 13 students, oxygen for six hours at high altitudes.

An instructor is supervising students seated at their navigator tables. Each position includes an instrument panel, radio altimeter, driftmeter, and access to loran equipment.

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Navy Gets New Sub-Killer

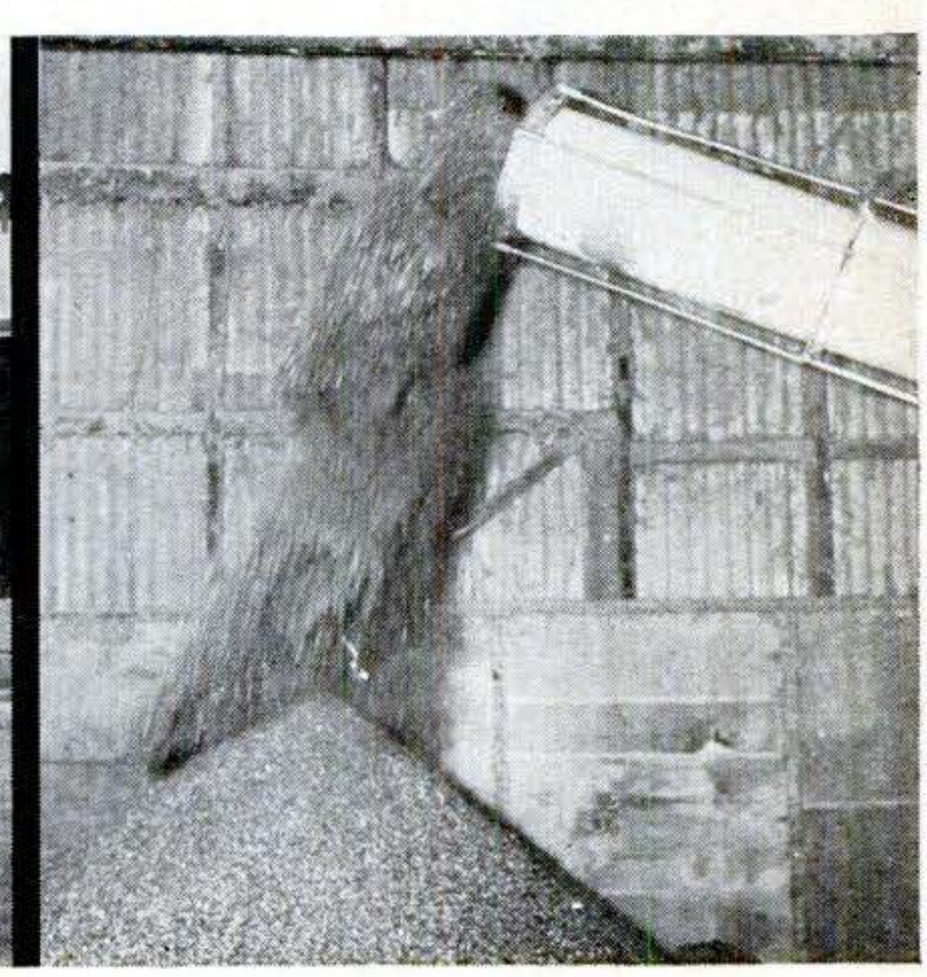
BRISTLING with nearly every known type of armament and detection gear, the Navy's new P2V-4, is especially designed to hunt and kill subs while roaming far at sea. For spotting subs, it carries radar, magnetic-detection gear, and sonobuoys. For the kill, it has a choice of torpedoes, rockets, bombs, mines, machine guns, and 20-mm. cannon. Exhaust gases from its two reciprocating engines drive prop-coupled turbines for added power. The P2V-4 is the latest version of the famed Lockheed P2V Neptune.

World's Largest Light Bulb

IF YOU had to pay the light bill for this bulb it would cost you as much as the combined light bills for 40 homes. Largest in the world, the 50,000-watt GE mammoth has a light output of 1,300,000 lumens and requires as much electricity as the most powerful radio broadcasting station. Its glass envelope above, made by the Corning Glass Co., is 35 inches high and 20 inches in diameter. GE uses the giant, 35-pound lamp, one of four made since the war, for lighting displays and research.

Automatic Tank Trucks Deliver Grain Like Oil

TO SAVE valuable labor during the war, dairy feed had to be carried in bulk, instead of packed in sacks. Now the Triangle Grain Co., of Bellflower, Calif., has borrowed the idea—this time to save farmers money. Its large, steel tank trucks can pick up as much as 20 tons in 40 minutes, and unload it in the same time. To make a delivery, a truck simply backs up to a barn, a jointed tube is extended (lower left), and a screw conveyer inside the tube discharges the grain into a bin (below). Savings in sacking, handling, and hauling time add up to about $10 a month for every cow.



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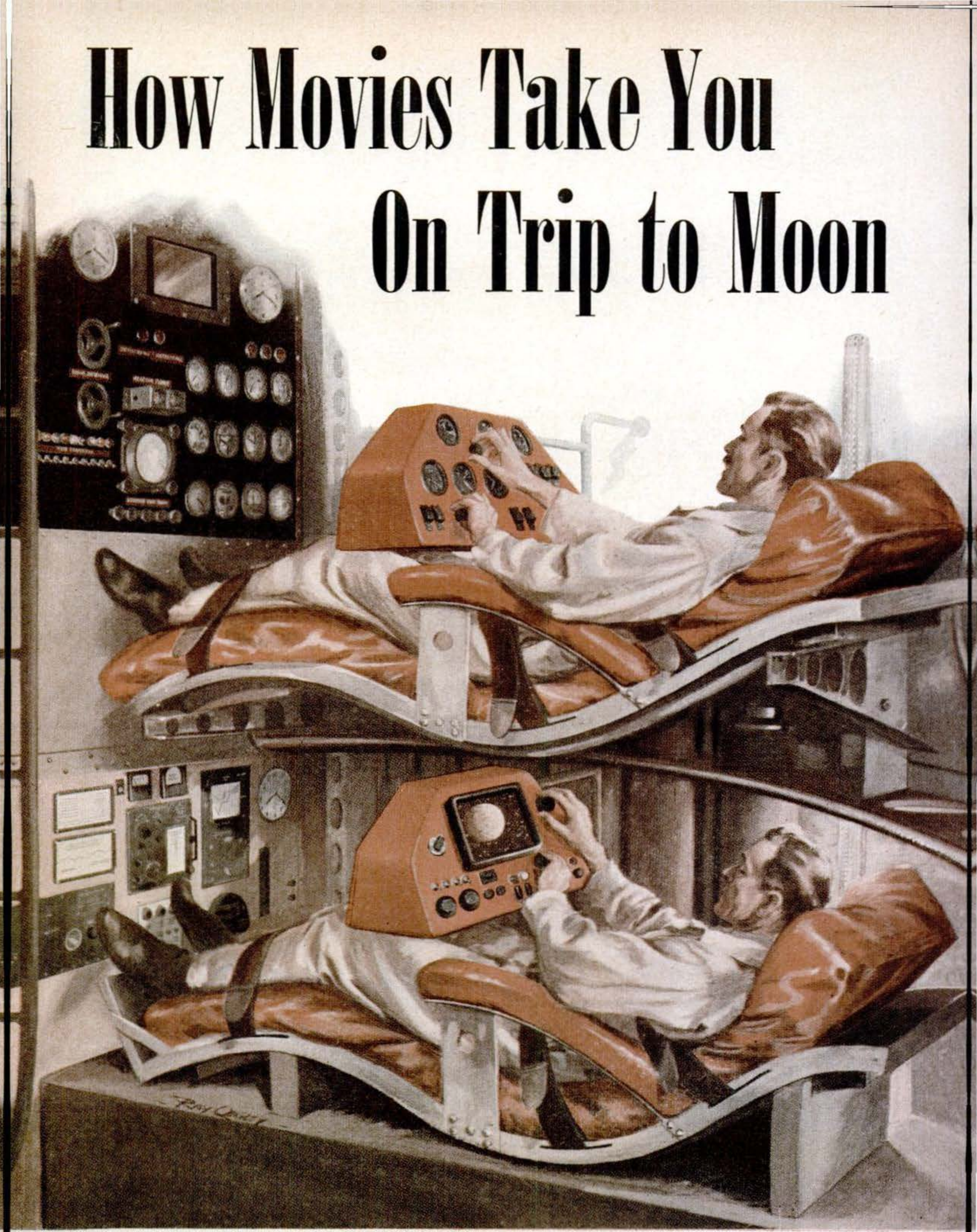
How Movies Take You On Trip to Moon



Strapped into cushioned couches, moon-bound rocket crewmen, each performing his own job, await take-off from earth in forthcoming movie "Destination Moon." Scientists provided the technical data, but outer space posed some problems only Hollywood could solve.

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Backstage visit to Hollywood's most unusual set reveals special-effects tricks that make rocket ride look real.

By Andrew R. Boone

WHEN Hollywood movie producers decided to make the forthcoming Technicolor film "Destination Moon," they ran into a few problems they hadn't bargained for. In outer space, where much of the action takes place, gravity becomes negligible and bodies drift aimlessly. That meant getting actors to float eerily in mid-air and walk around the walls and ceiling of their space ship just as easily as on the floor.

But nothing's impossible in Hollywood—not even a rocket trip to the moon. Ernst Fegte, art director for the George Pal production, got an idea. If you can't turn the actors upside down, why not turn the set? The result was a boxlike set, representing the interior of the rocket's cabin, that could revolve like a cement mixer. To show an actor walking on the ceiling, the set was simply rotated until the ceiling became the "floor."

The next step was to rig up a camera in a revolving drum so it could roll with the action or shoot upside down. Then the upside-down set was shot with the camera also upside down. What the audience sees is a right-side-up set with upside-down actors.

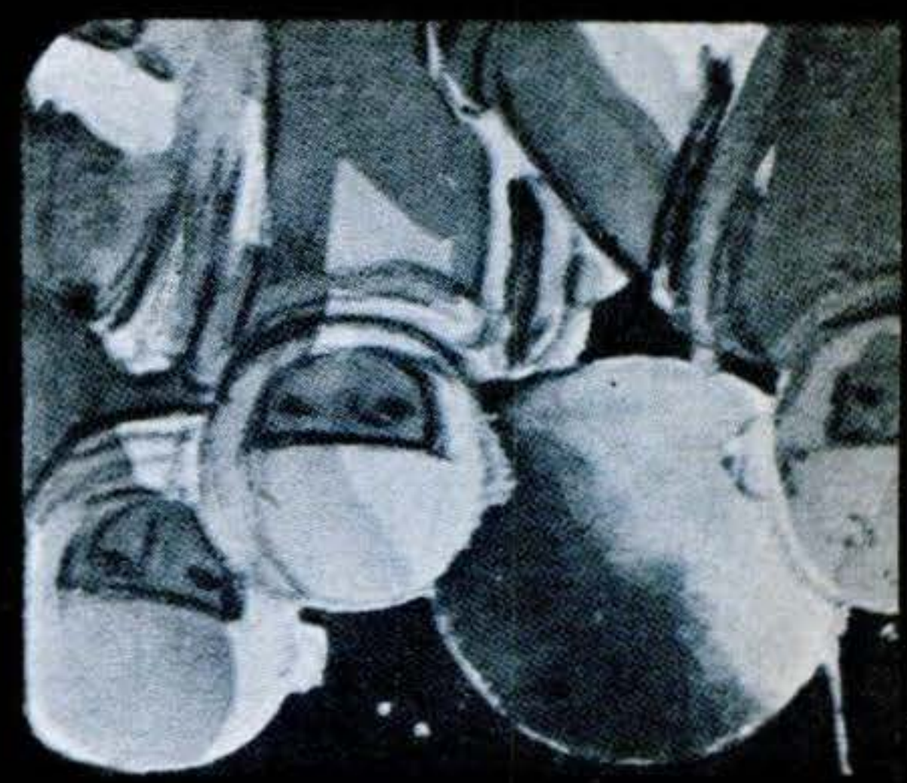
For the mid-air scenes, technicians dusted off the old wire trick, long used to levitate Little Eva, Peter Pan, and assorted angels. But they added a new wrinkle. The scenes were shot in many cases with both the set and camera turned on their sides. On the screen, viewed upright, the wires appear to run across the film instead of upward. The unsuspecting audience never notices them.

Though imaginary, the film represents some of the best scientific guesses as to what a rocket trip to the moon might be like. Many of its scenes were designed with the help of astronomer-artist Chesley Bonestell, illustrator of rocket-expert Willy Ley's *Conquest of Space*. Other scenes were based on actual photos from Mt. Wilson Observatory. But it remained for filmland's magicians—the special-effects men—to bring outer space to an earth-bound movie screen. Some of the tricks they used are shown here.

Preliminary shooting sketches helped visualize difficult scenes like the exciting mid-journey adventure in outer space shown at the right.

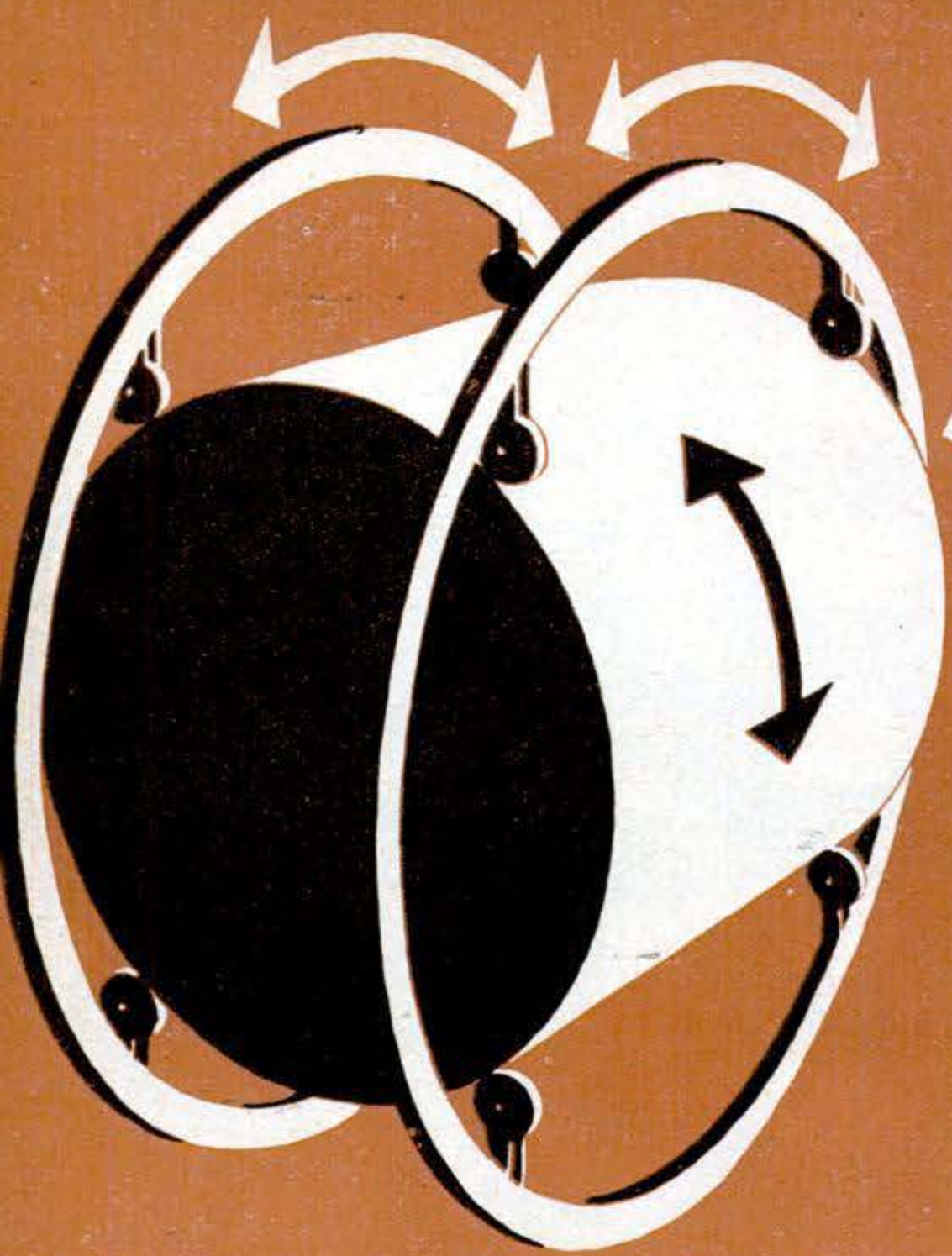
Men emerge from ship's underside . . .

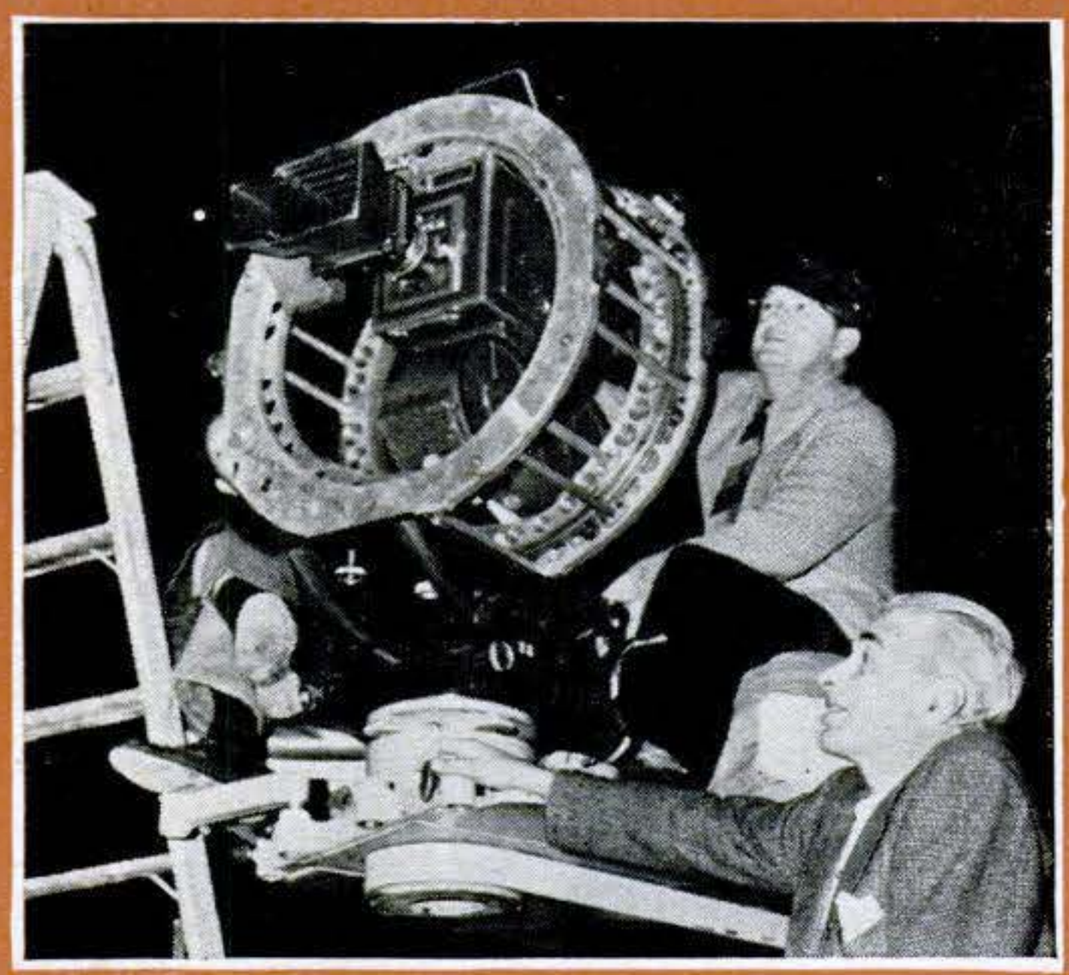
. . . with the moon ahead of them . . .



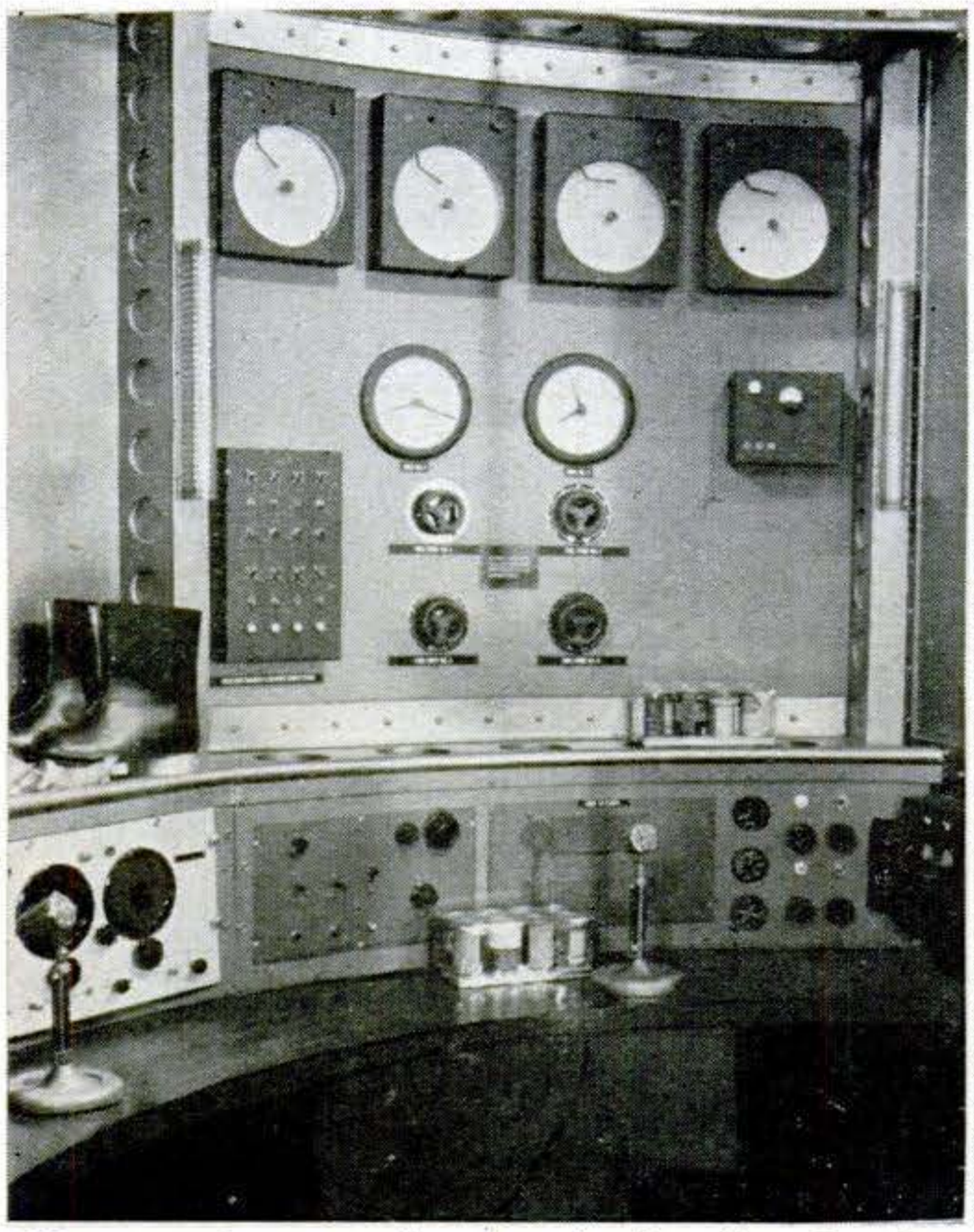
. . . and the earth at their backs . . .

. . . then walk around ship's hull.

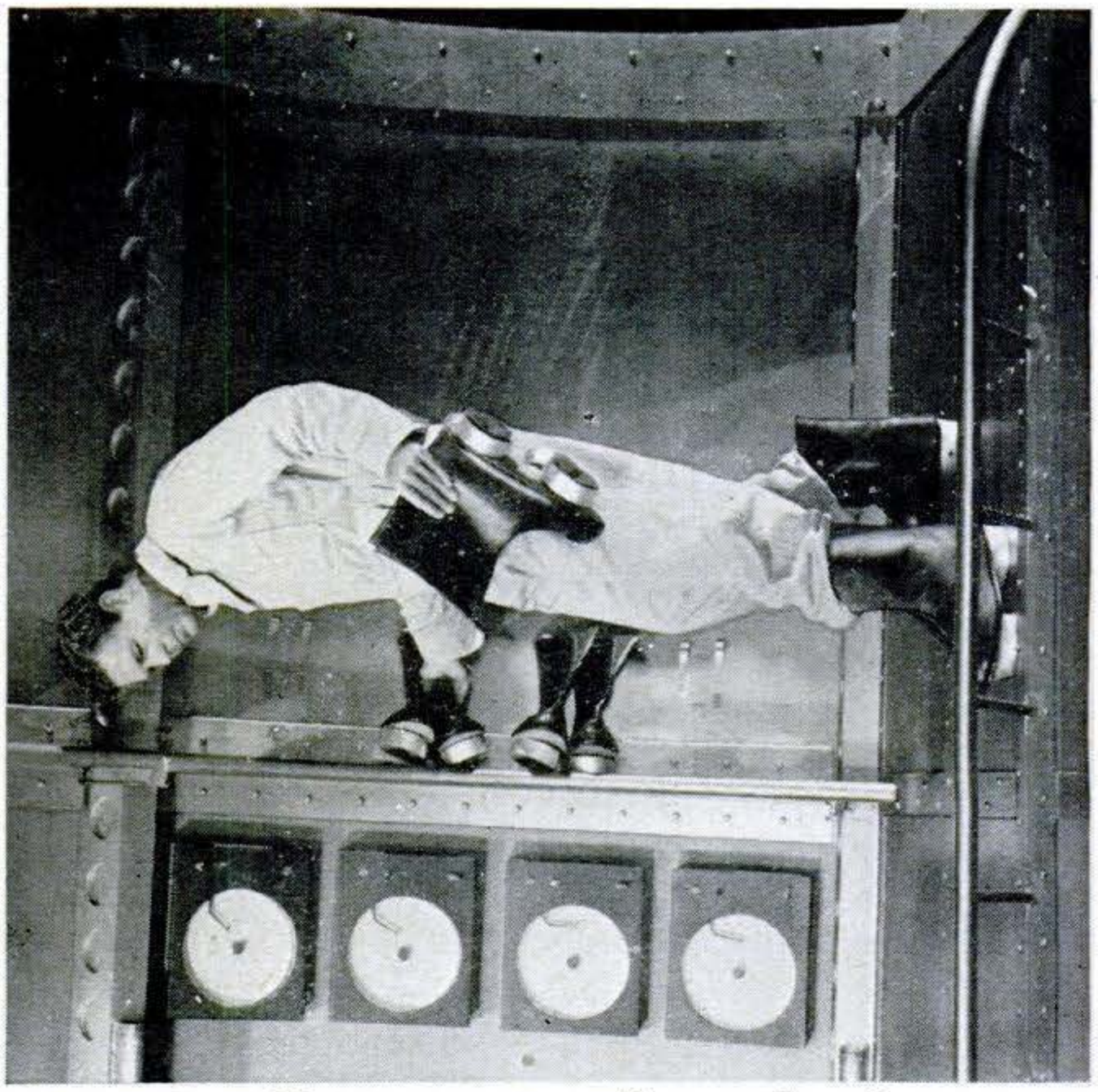




Drawing above shows how rings and rollers permit rocket set to revolve in two directions simultaneously. Special drumlike, revolving camera housing (inset) enables camera to shoot on its side or upside down to create illusion of men standing on walls or ceiling. Rotating both camera and set at same time makes men appear to walk right up walls and across ceiling.



All controls are realistic to the last detail. This main control board, a credit to any real-life installation, carries fuel-pump controls, flight gauges, and various lights and switches.



Beyond earth's gravity, men walk on walls and ceiling, using magnetic boots. To get effect, set and camera were turned on their sides. In movie, however, audience sees it this way.

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Set's six removable walls permit boom-mounted camera to shoot through any side. Inner, cylindrical section, representing rocket's cabin, revolves horizontally, driven by electric motor. Outer, ringlike frame rotates vertically, turned by stage crew pulling ropes. Two motions together permit set, which weighs 18 tons, to be turned to any angle desired.

Studio technician adjusts war-surplus oxygen tanks that were used to supply air pressure for inflating space ship's couch cushions. An air pump kept pressure in tanks at proper level.

Airtight, pressurized space suits are made to look inflated with wire stays and padding. Men appear to talk through microphones in helmets, but sound is actually dubbed in later.

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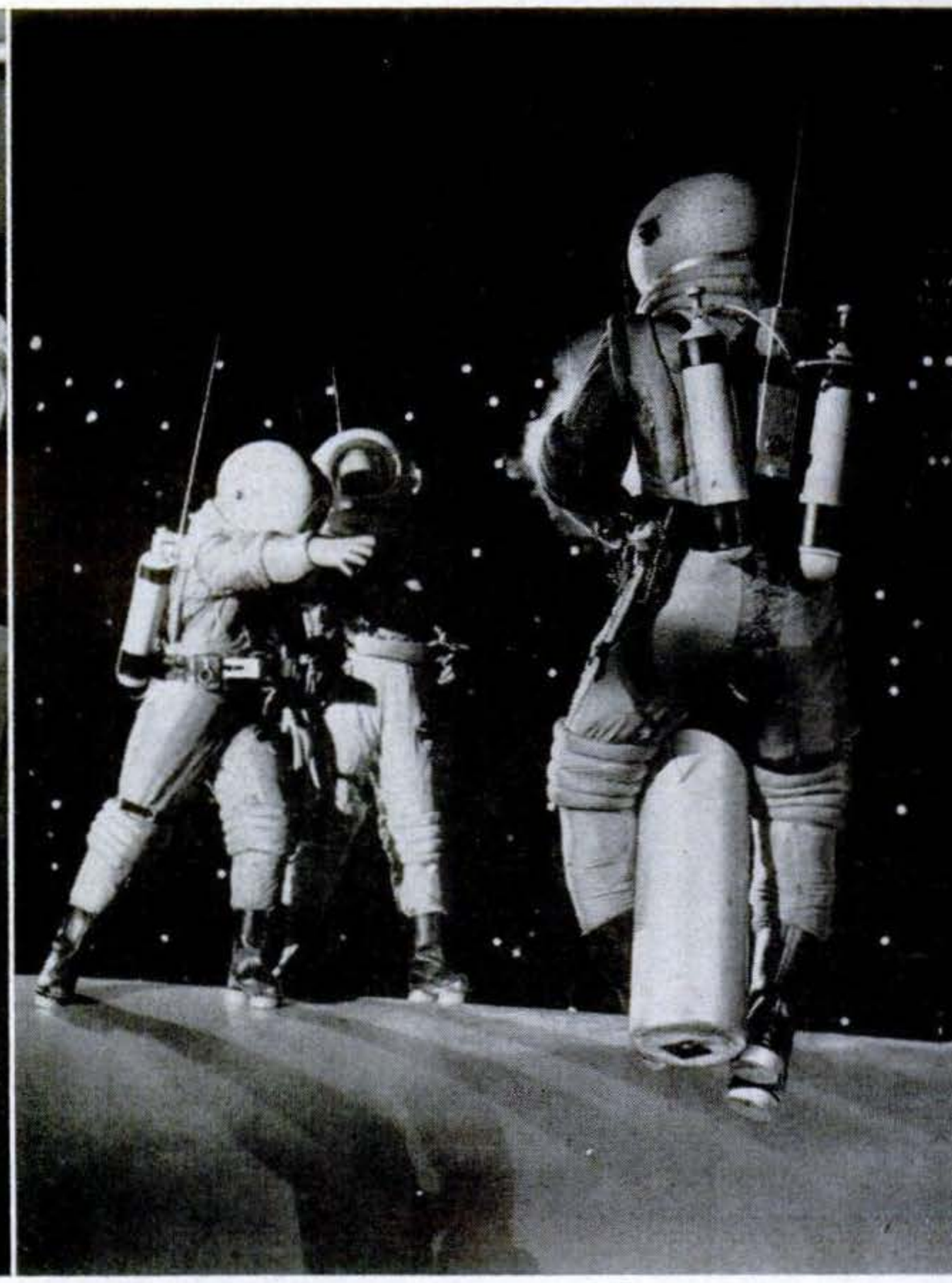
For outer-space scenes, where men frequently float in mid-air, actors had to be supported by thin wires attached to this special steel harness running the full length of their bodies.

Wires from actor's harness are supported by overhead carriage, called "spider," that can be moved to simulate man floating through space. Wires are attached while actor lies on couch.

To simulate six-G force of take-off blast, actors' faces are made up to look strained and taut. Air suddenly released from inflated couch cushions makes crewmen appear to sink under force.



When crewman falls off rocket while inspecting antenna, audience sees fellow crewman—actually supported by wires—ride oxygen bottle to rescue, using gas jet to propel him.

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With wires attached, actor is raised off couch, ready for action. Proper lighting, staging, and camera angle make thin wires, here faintly visible, almost undetectable in final picture. To conceal wires further, some scenes were shot with both set and camera on their sides so that when picture is turned upright, wires appear to run horizontally instead of vertically.

Moon set, representing 24-mile Harpalus crater, was based on photos from Mt. Wilson Observatory. Built up of wood and plaster, it covers nearly an acre. Mountains in background are painted backdrop. Stars are 2,200 auto bulbs hung against black velvet curtain. Because moon's gravity is 1/6 of earth's, man easily carries 600-lb. Schmidt telescope.

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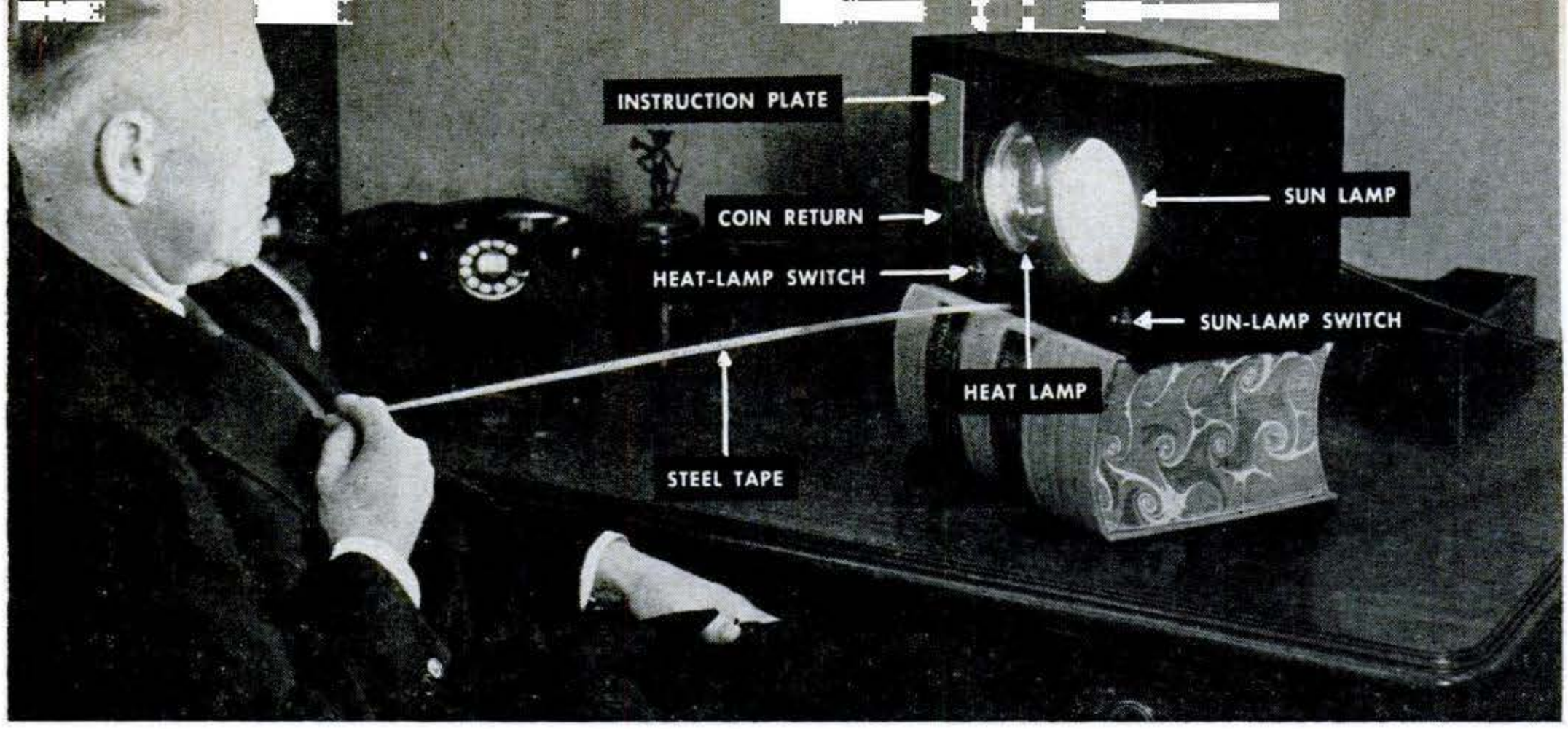
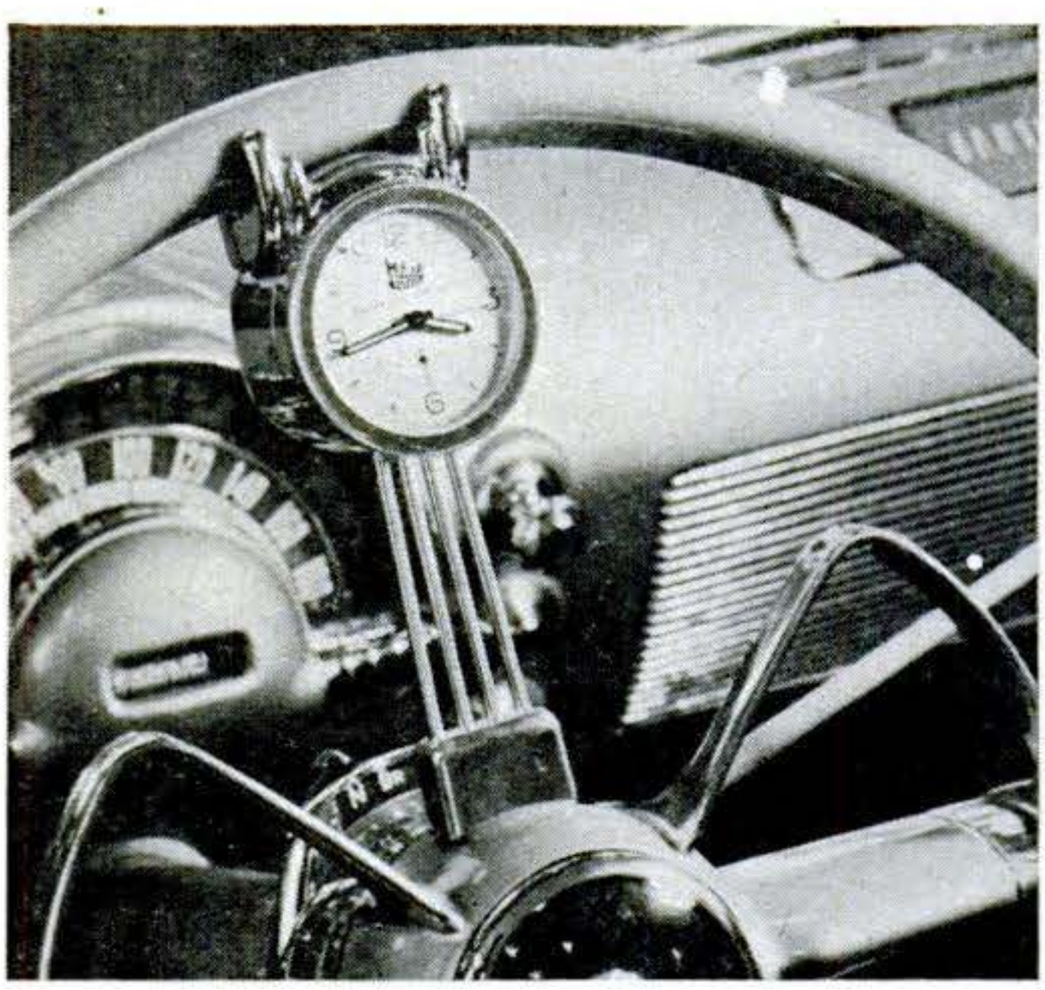


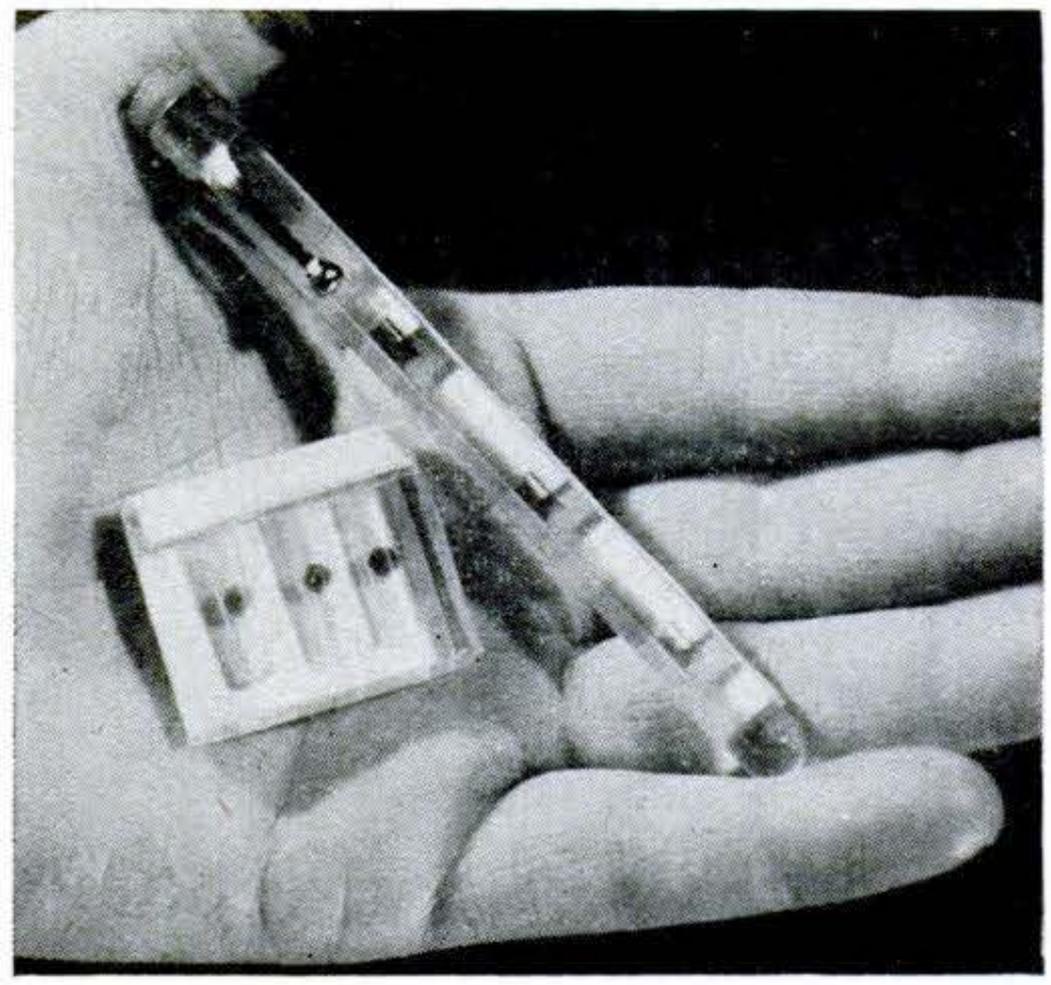
Coin Lamp Tans As You Wait

You may soon be able to get a sun tan while waiting in a doctor's office, beauty shop, or railroad station. This compact, coin-operated sun lamp is shown above on the desk of a General Electric engineer who is demonstrating the steel pull-out tape that measures proper distance between lamp and face or other exposed parts of the body. An automatic timer controls exposure. To increase the sun lamp's effectiveness, it also has a heat lamp to hasten tanning by producing moderate perspiration.



Car Clock Winds Itself

The jolts and jounces that sometimes damage an ordinary car clock are just what the doctor ordered for this Swiss-made Maar clock. Mounted on the steering wheel, it has a pendulum that starts swinging at the slightest motion of the car. The pendulum's swing rotates gears that in turn wind up a spring. Impossible to overwind, the clock will run a full day on a half-mile drive, a week on seven and a half miles, and nine days when fully wound. If lack of use stops it, a 200-foot drive will start it up again. Mounted like a gyroscope, it operates in any position of the steering wheel.



Radiation Detectors Fit Pocket

These two tiny new detectors, easy to read, can give a quick report on gamma and x-ray radiation levels. Developed by U.C.L.A.'s Atomic Energy Project, they fit neatly into a pocket. Each clear-plastic container holds three vials of chloroform and a purple dye. When the chloroform is irradiated, it releases acid that turns the dye yellow. Each vial is adjusted to turn yellow at a different amount of radiation, so the user can tell immediately how much radiation is present by simply noting which vials have changed color. Complex apparatus was previously needed for this job.

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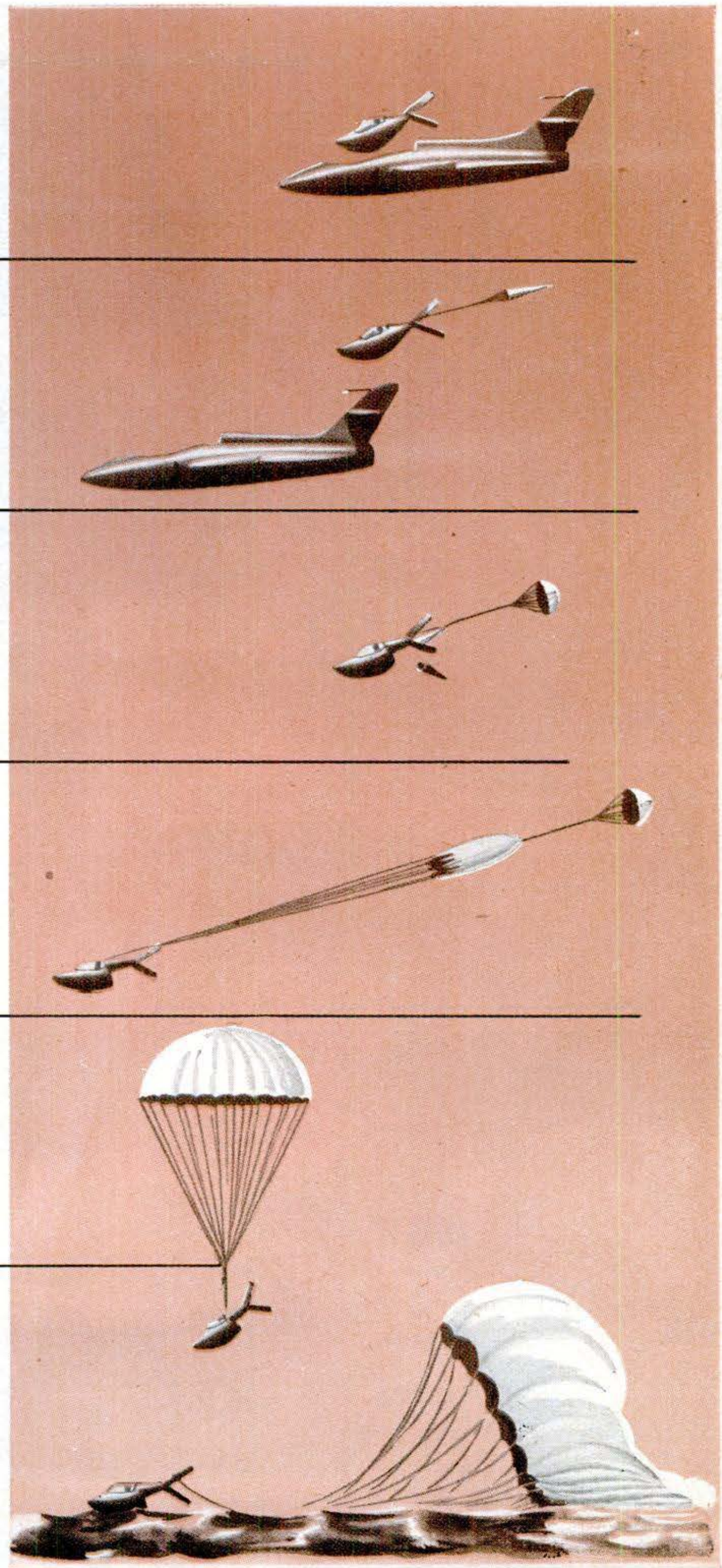
Pilot Ejected in Pod...



1 **A new Navy** ejection cockpit capsule, completely enclosed, pressurized, and insulated, will enable pilots to escape from supersonic planes at high altitude. A lever releases the pod, as shown at right.

2 **As the pod-and-pilot** is blown free of the speeding plane, stabilizing tail fins are extended to prevent the capsule from tumbling through the air during descent. Next a small drag 'chute is shot out.

3 **This drogue parachute,** fired automatically, gives added stabilizing effect as the escape unit loses forward speed. It also develops enough tension to pull open capsule's main 'chute door, which drops off.

4 **Out comes** the main parachute. If this should become fouled or ripped, the pilot, on reaching a lower altitude, can slide forward the capsule's overhead canopy and escape by using his personal parachute.

5 **Main 'chute** billows out to slow capsule's descent. Breakaway unit, developed by Navy Bureau of Aeronautics after two years' research, can be used for emergency escape over land or sea.

6 **After capsule** strikes water, pilot releases 'chute. Unit then becomes a stable boat from which he can use battery-powered radio to direct rescue. The capsule will be flight tested later this year.

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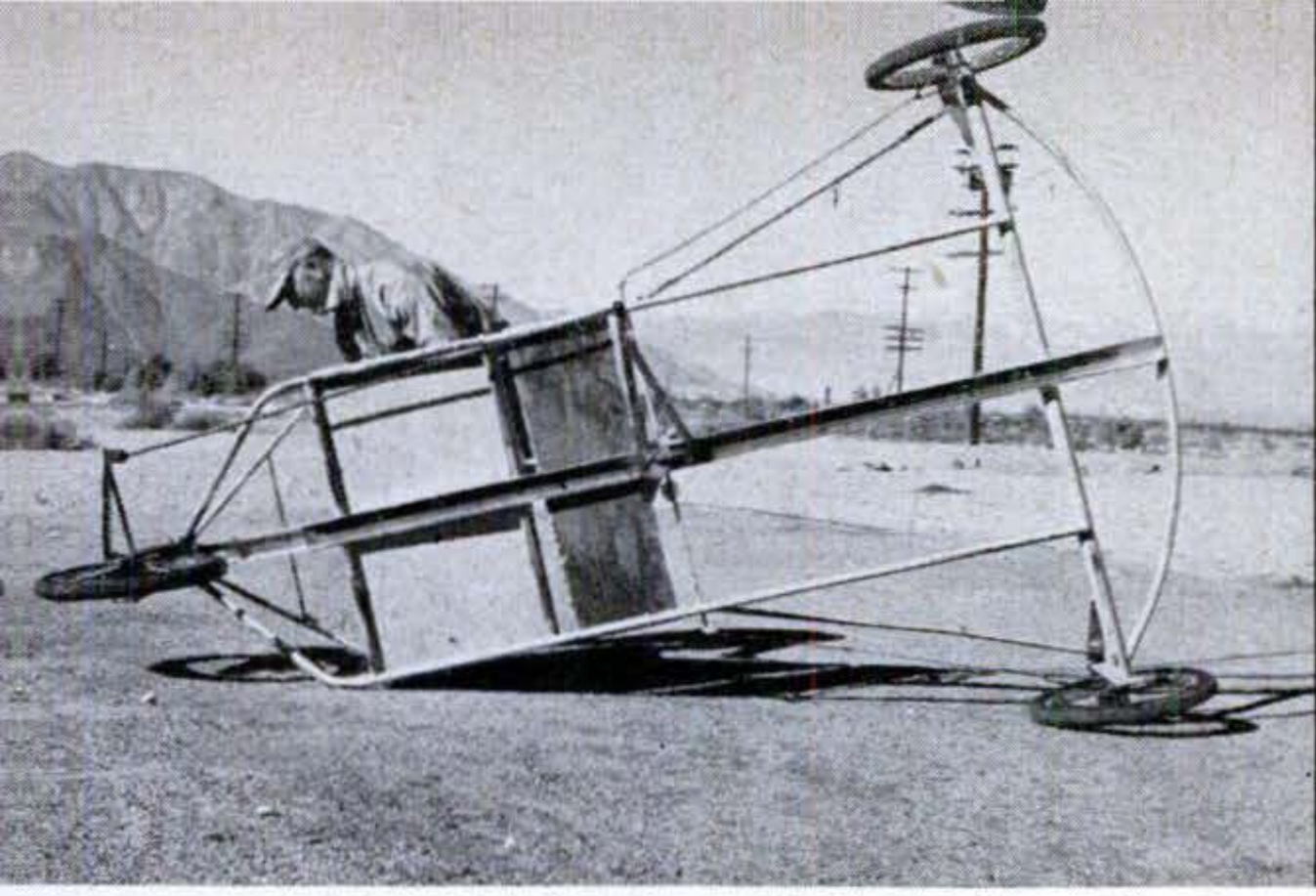
Land Boats Sail 50 M.P.H.

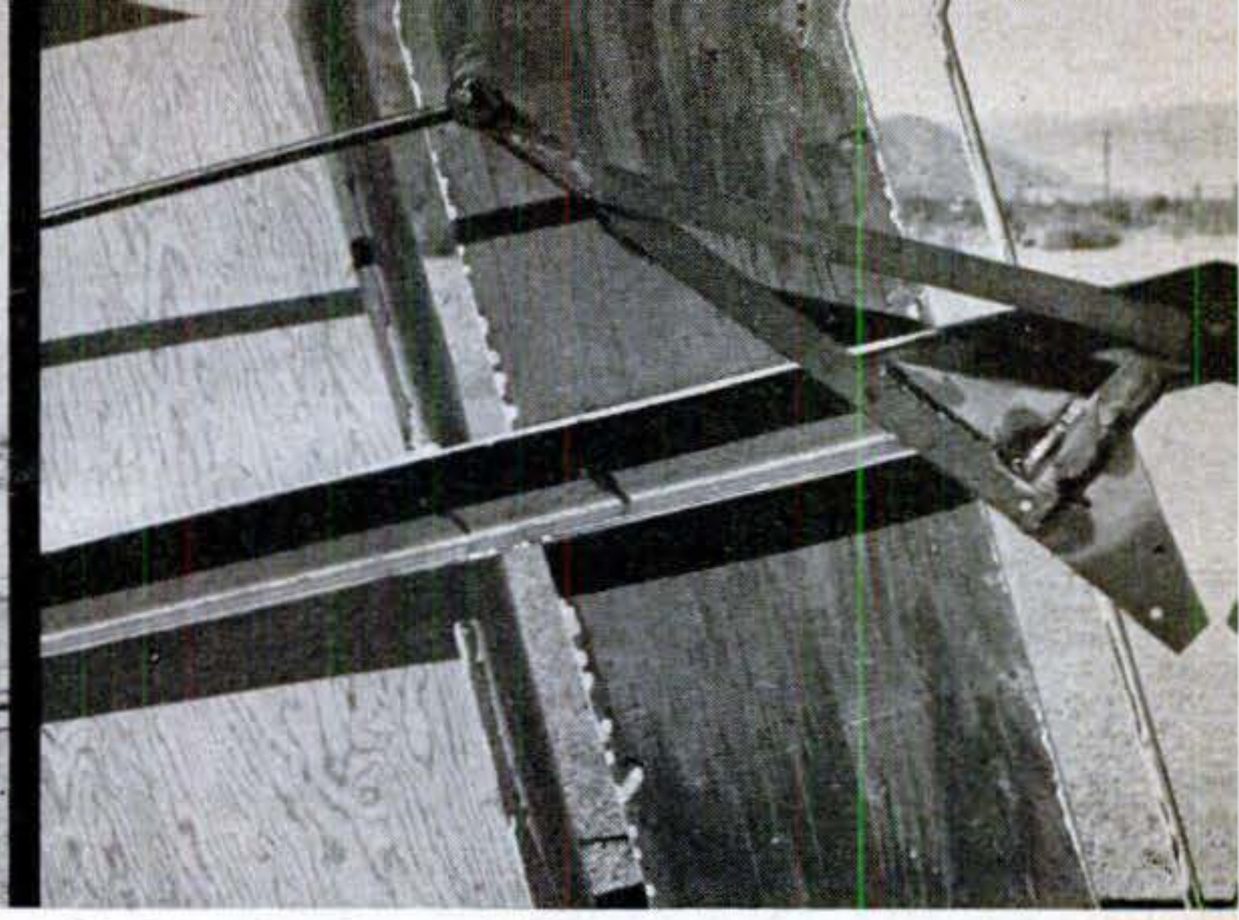
Four dry-land "sailboats" line up for a thrill-packed race more than 60 miles inland from sea.

DRY-LAND yachting provides exciting sport for Palm Springs, Calif., enthusiasts, who boast a fleet of six fast land "sailboats." The novel craft were designed and built by Ray Miller, one-time musician and NBC musical director. While they will run on hard sand or dirt, best sailing is along concrete strips of a nearby Air Force base, now largely abandoned. A 20-mile wind propels the machines at speeds up to 50 m.p.h.

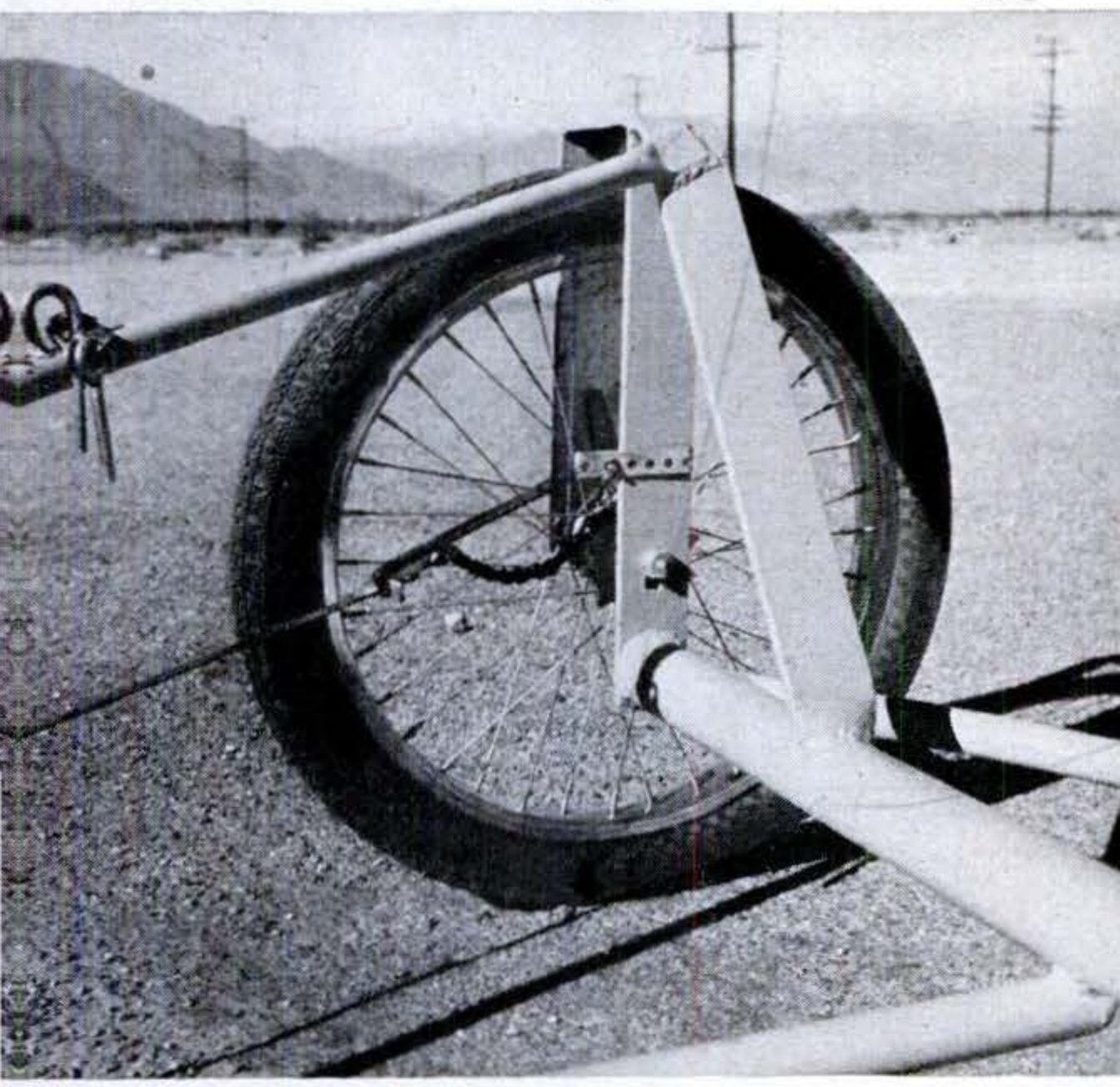
Ray Miller, designer of land yacht, holds tiller that steers it by turning its rear wheel.



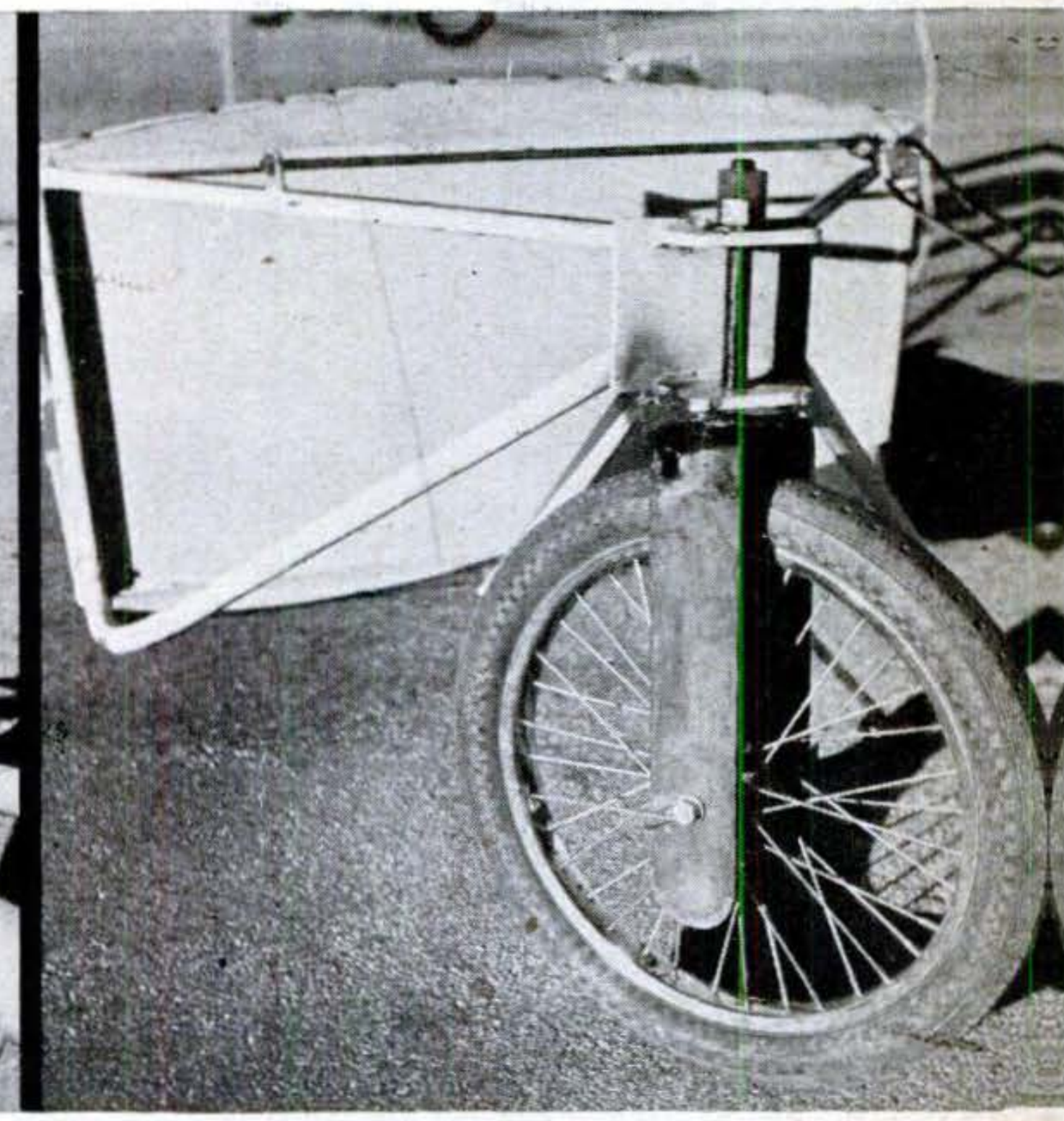
Three-wheeled craft, laid on side to show underpinning, weighs 149 pounds complete. Ride is cushioned by springy tubular-steel frame.



Underside close-up shows steering arm, operated by tiller. A connecting rod leads to a similar arm turning the rear-wheel mounting.

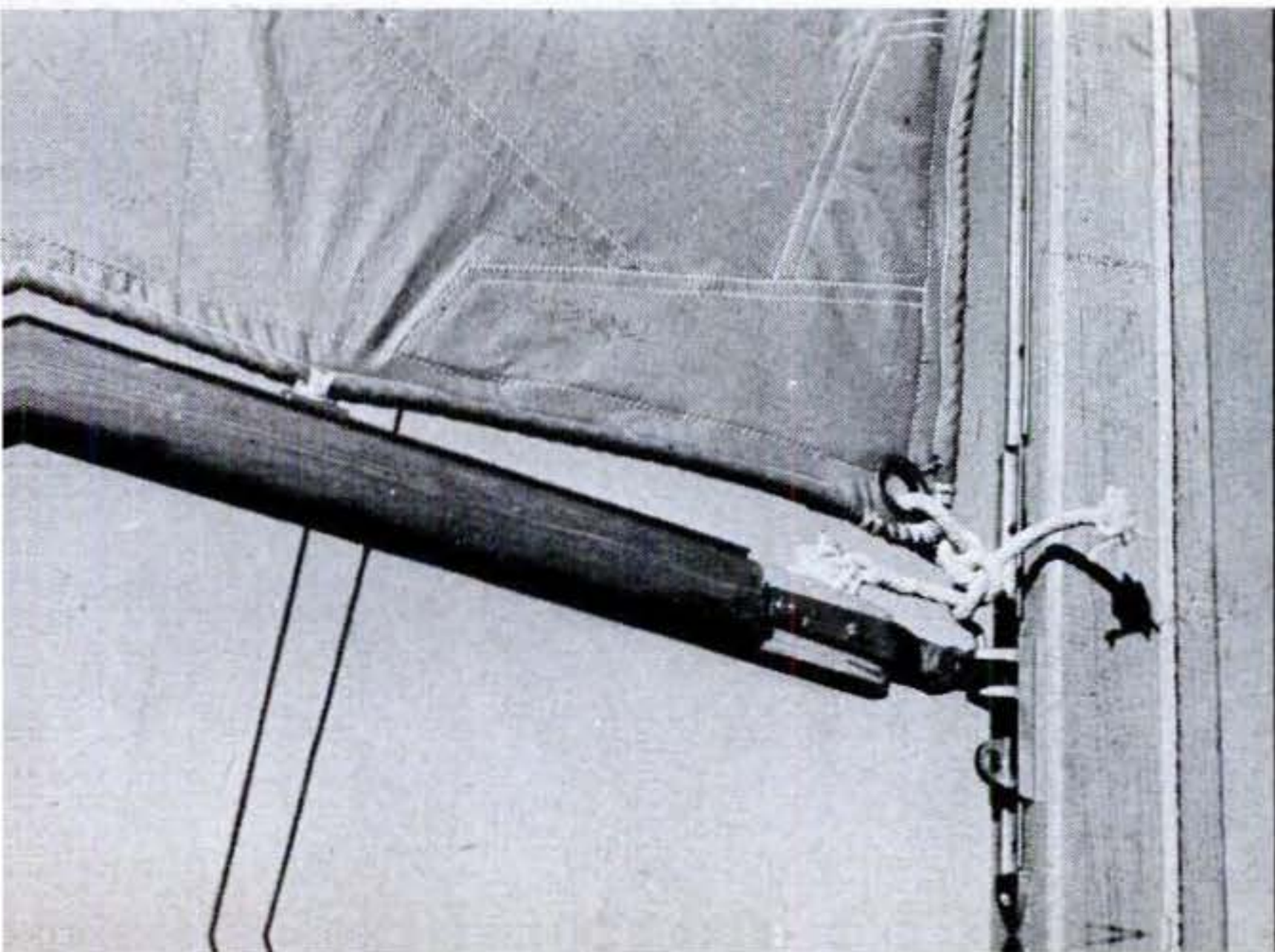


Low-hung frame with inverted-U wheel mountings keeps center of gravity within four inches of ground. Pedal works bicycle-type brakes.



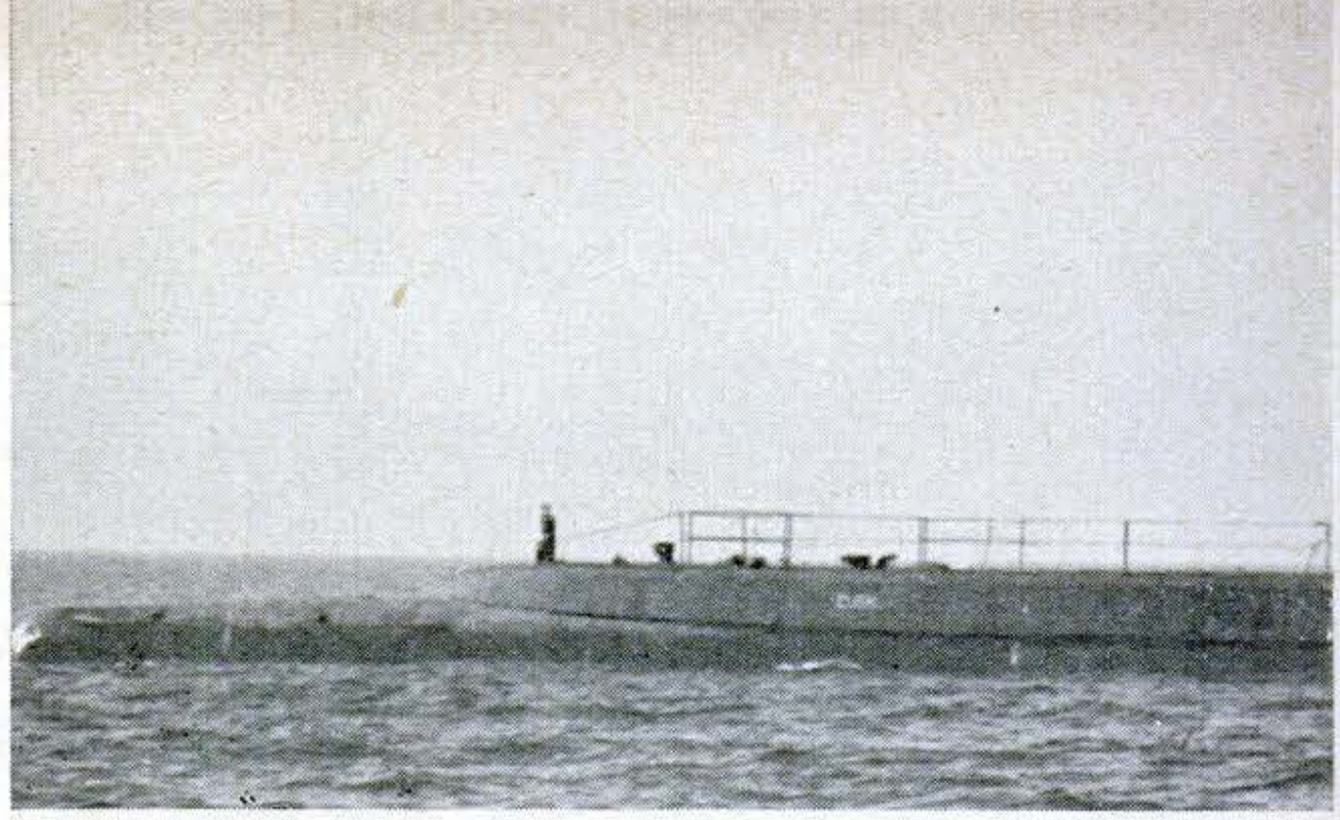
Rear wheel swivels 35 degrees each way for steering. All wheels have bicycle tires, and heavy-duty spokes for safety in fast turns.

Twenty-eight-foot mast of Oregon spruce carries 100 square feet of gaily colored sail. Boom and halyards are like those of water craft.

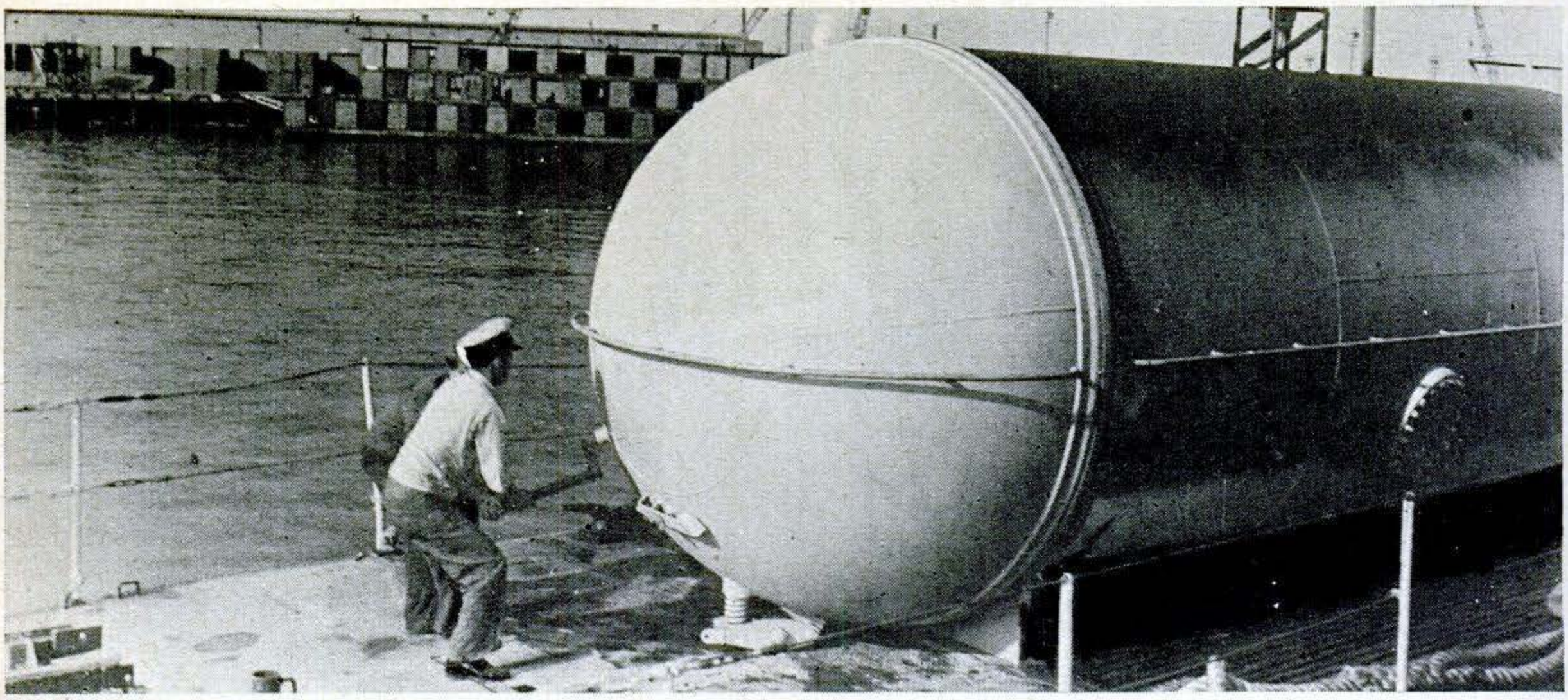


Miller inserts stiffener in sail as it is hoisted. Anyone who can sail a boat learns knack of land yachting in a few minutes, he says.

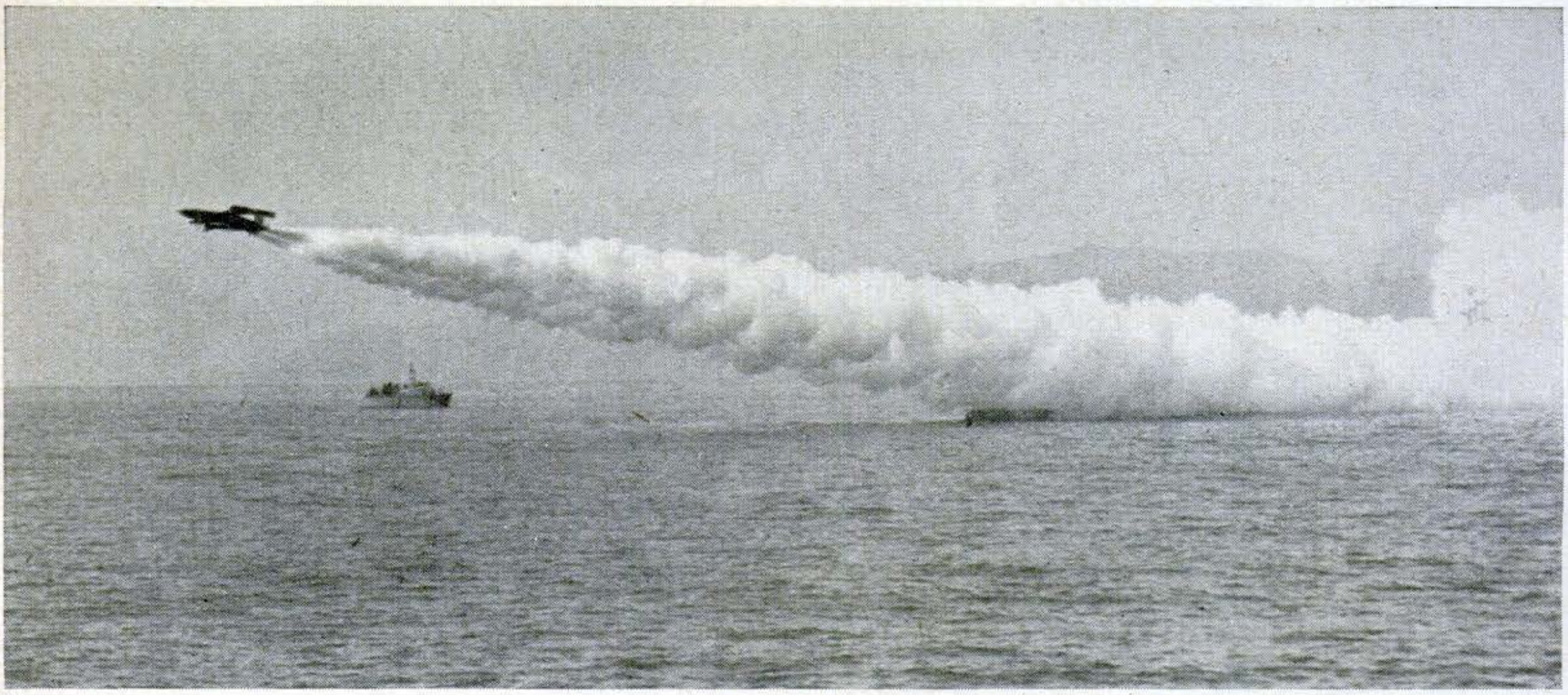
Sub Fires Guided Missile



Uncle Sam's pigboats are adding a new attack weapon—aerial torpedoes. Launched by rockets, they speed at more than 400 miles an hour, pushed by pulse-jet engines. Radio directions



The Loon, disassembled, rides to the launching point sealed in this "hangar" on the submarine's deck. Here crew members are shown fastening door of the 10-ft. by 30-ft. steel capsule.



Enveloping the *Cusk* in a trail of smoke, the Loon climbs skyward on its 150-mile flight. When beyond radio range of launching sub, a control system takes over, guiding it to target.

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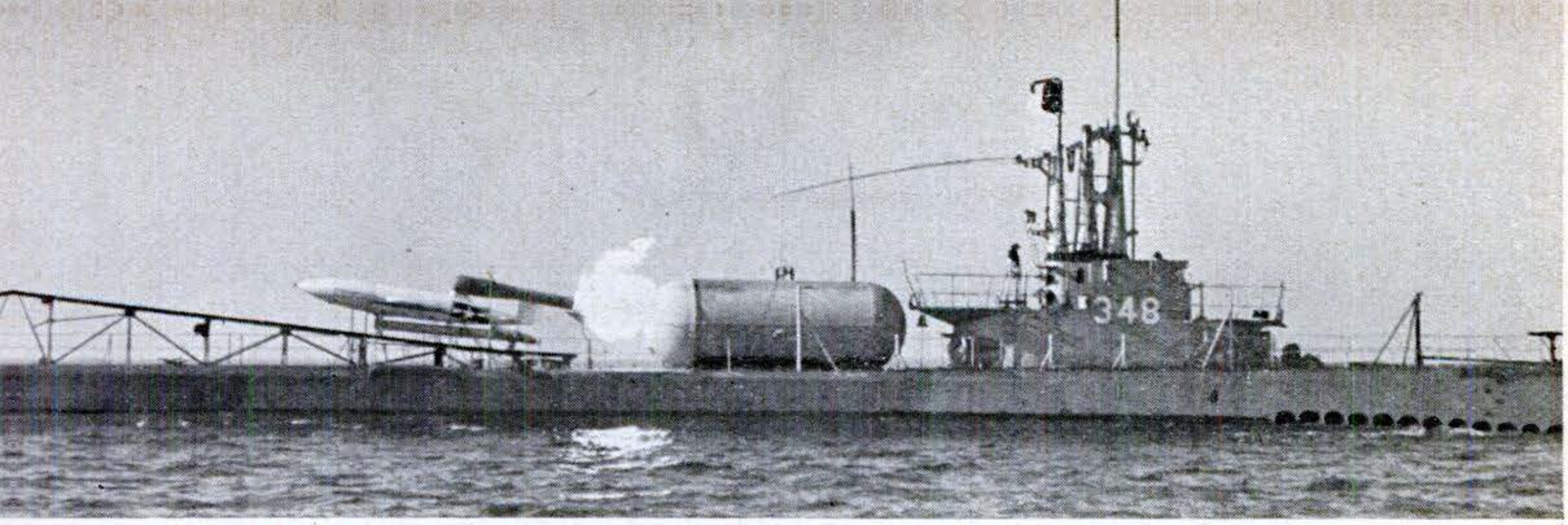
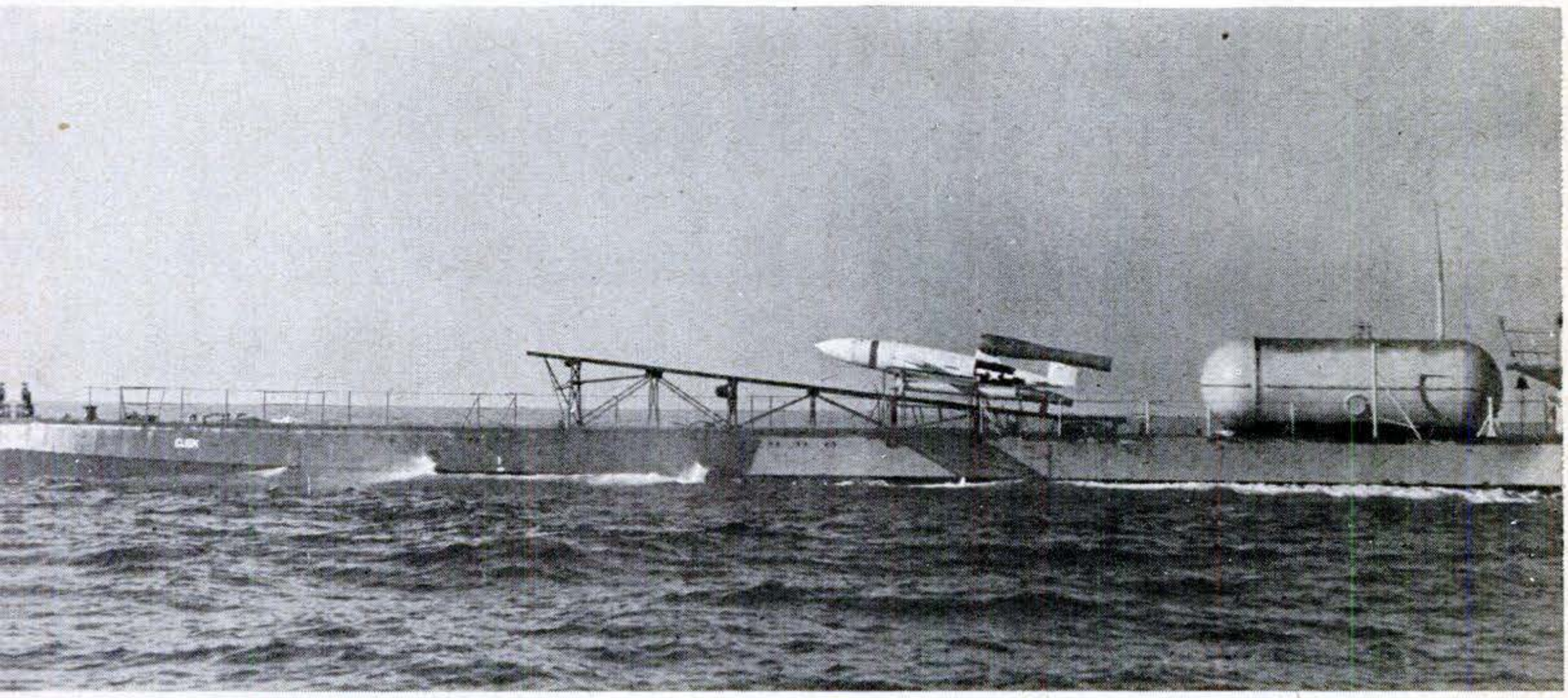
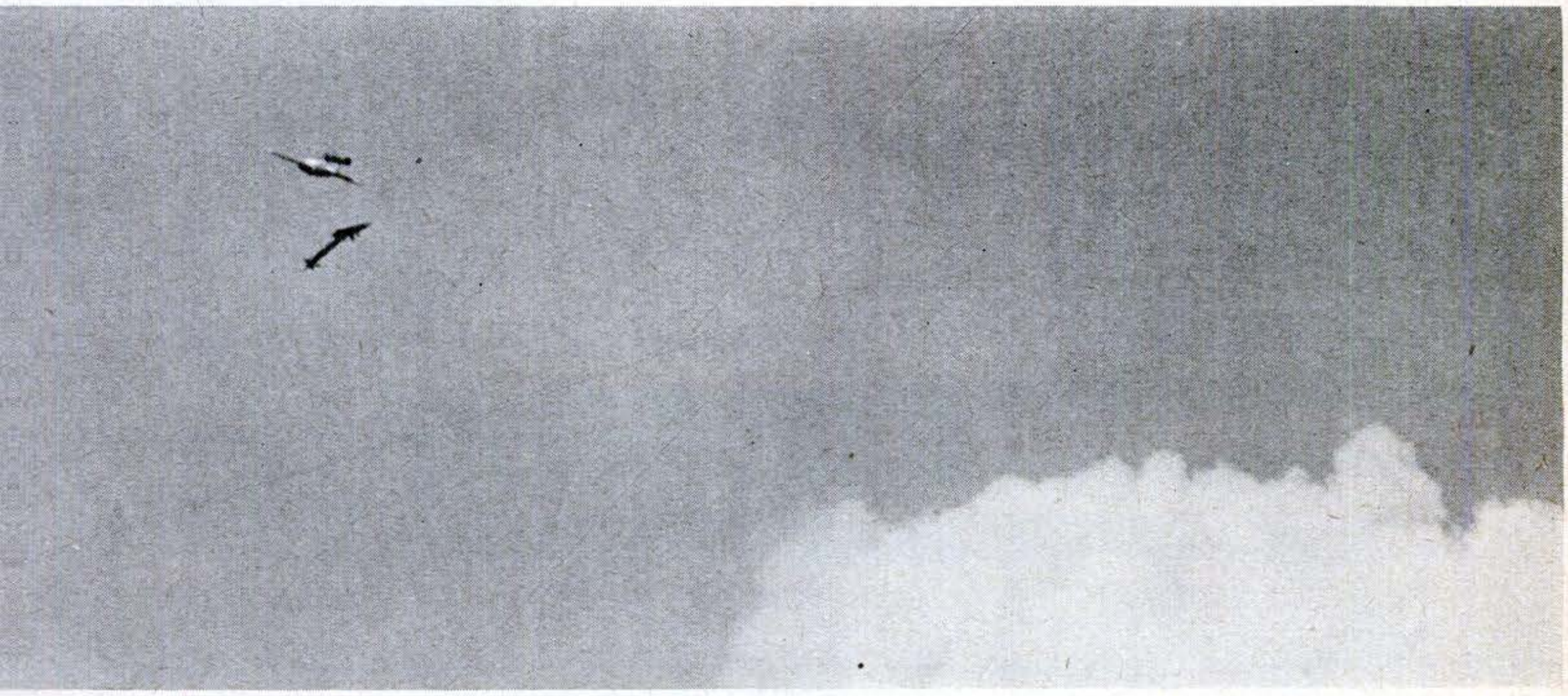


from the sub's control center guide them to their distant target. Recent successful experiments from the deck of an old-type submarine, the U.S.S. *Cusk*, shown above with a Loon (modified V-1), has led the Navy to convert another submarine, the U.S.S. *Carbonero*, for launching guided missiles—perhaps even one that can deliver the atom bomb.



Ready to go, the Loon is now poised on its ramp. Hanger only cuts sub's underwater speed slightly, but newer types will probably carry missiles inside, raise them to deck for launching.



When rocket motors have boosted the Loon to a speed of 225 m.p.h., about 200 yards out, the pulse-jet engine picks up. The exhausted rockets then drop off, as shown in above photo.

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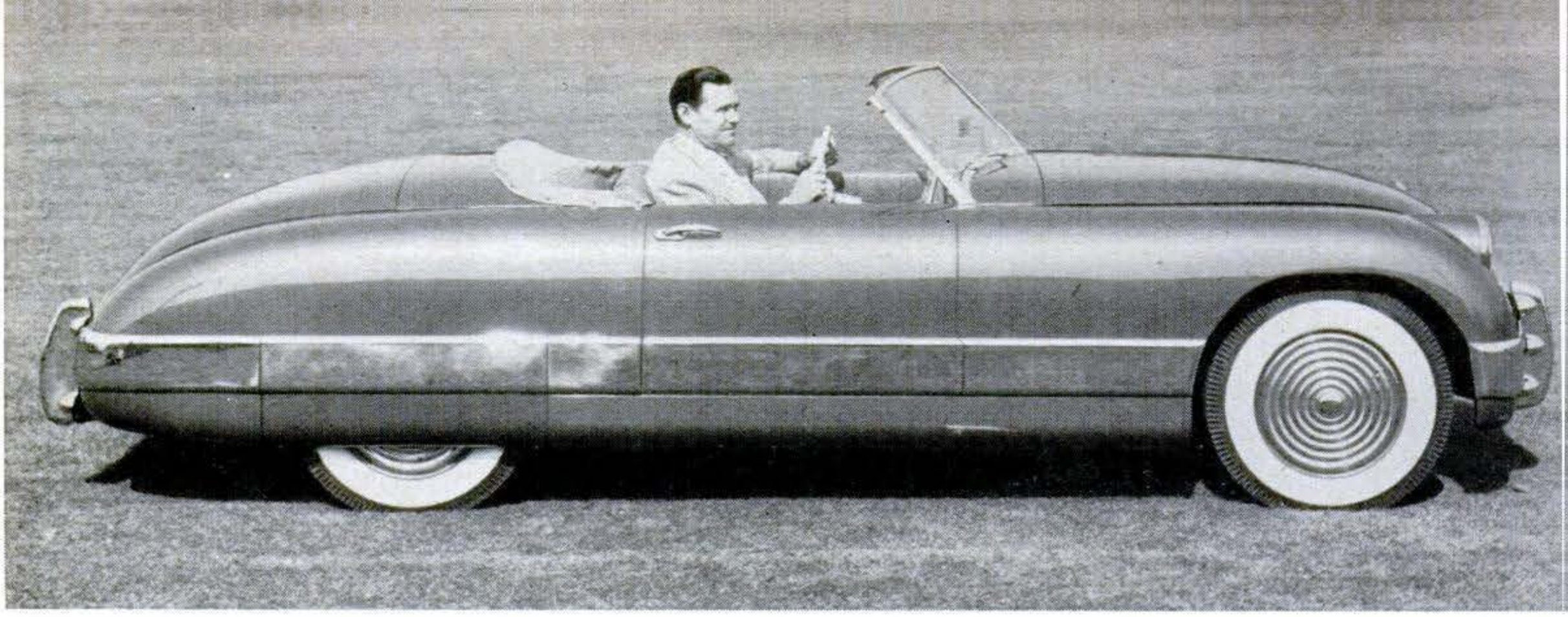


New build-it-yourself car combines sporty lines with speed of a hot rod. With souped-up Ford V-8 engine, the 2,400-pound sportster hit 142.515 m.p.h. on Utah's Bonneville Salt Flats.

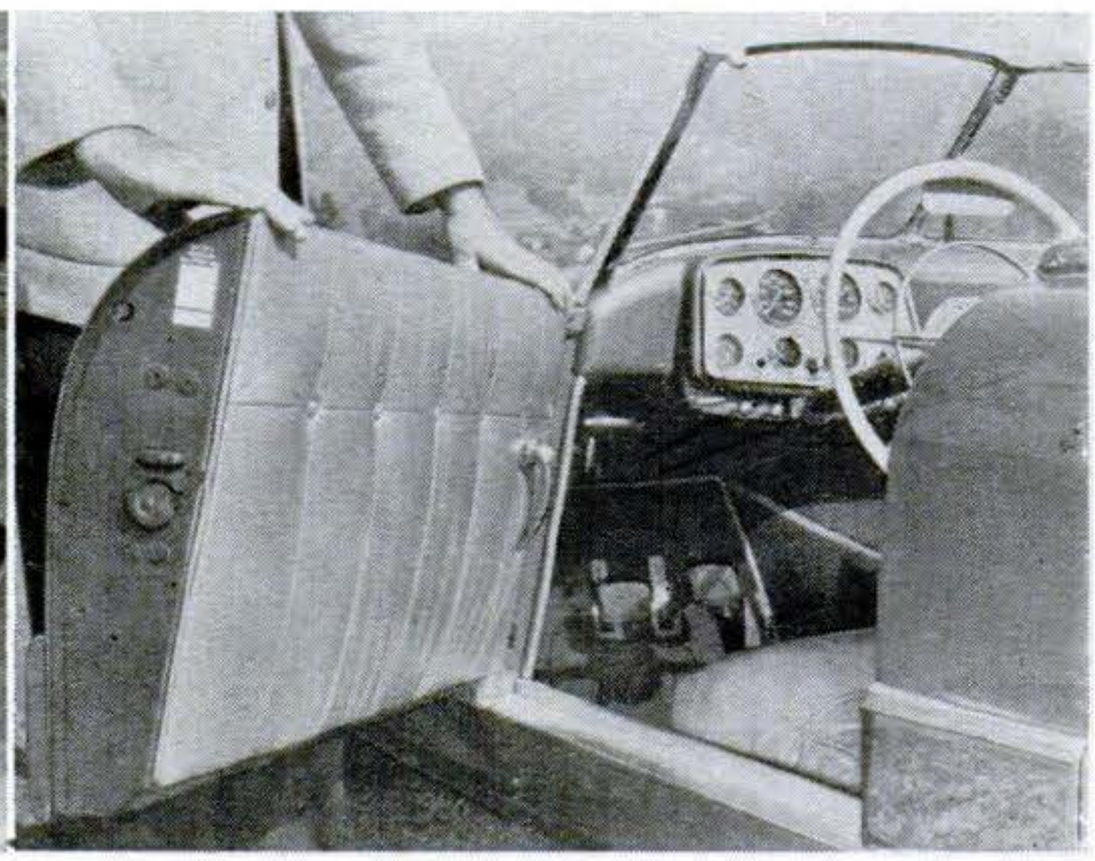
Sports-Car Kit for Building Your Own

EVERYTHING comes in kits these days—television sets, furniture, even houses—so why not a car? That's just what Frank Kurtis thought one day as he tuned up racers for the Indianapolis Speedway. Not only would it cut the cost of the car, but it would let the tool-happy tinkerer add a few ideas of his own. Today, auto enthusiasts all over the country are buying his kits, getting out their tools, and coming up with some of the snappiest cars on the road.

Unique in design, the build-it-yourself car combines the sleek lines of a luxury sports car with the get-up-and-go of a hopped-up hot rod. Seating two persons, it stands only 51 inches high and has a low center of gravity to make it hug the road. Customers get a choice of engines or can add their own. For the speed bugs, special souped-up engines are available.

The snappy sportster, made by Kurtis-Kraft, Inc., of Glendale, Calif., can be bought complete or in various stages of assembly. Ready to run, it costs $4,000, but a partially assembled version, less engine and transmission, is available at $2,800, and the basic frame, unplated body panels, and rough castings can be had for $1,500.

Car's six-foot designer Frank Kurtis shows there's plenty of room inside. Both steering wheel and seat are adjustable. Use of Ford overdrive gives added speed and saves gas.



Heavy rugs and leather trim add to beauty of car's interior. Low center of gravity, 20½ in. above ground, makes car hug road. Fabric top rolls up and glass side windows are removable.

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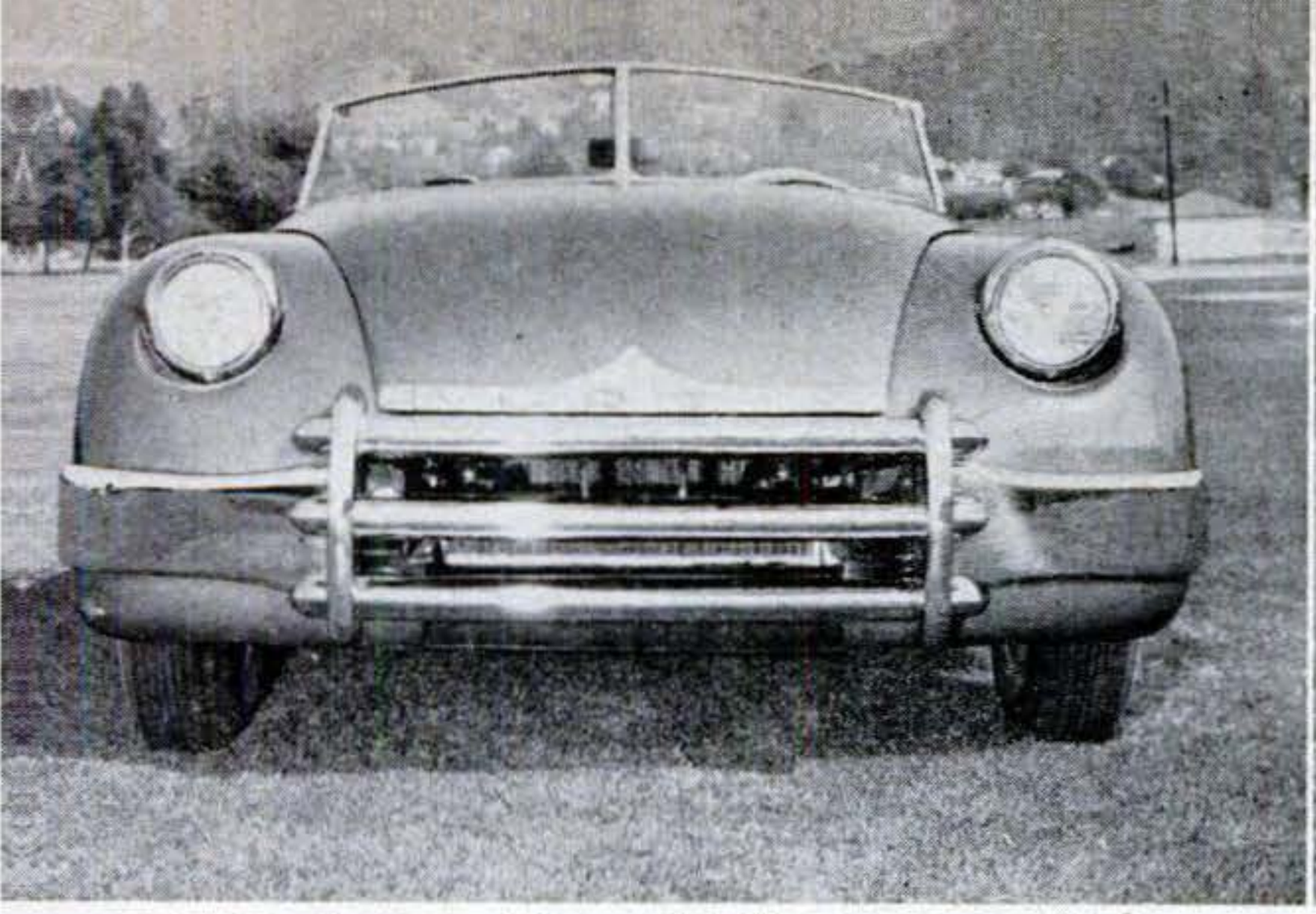
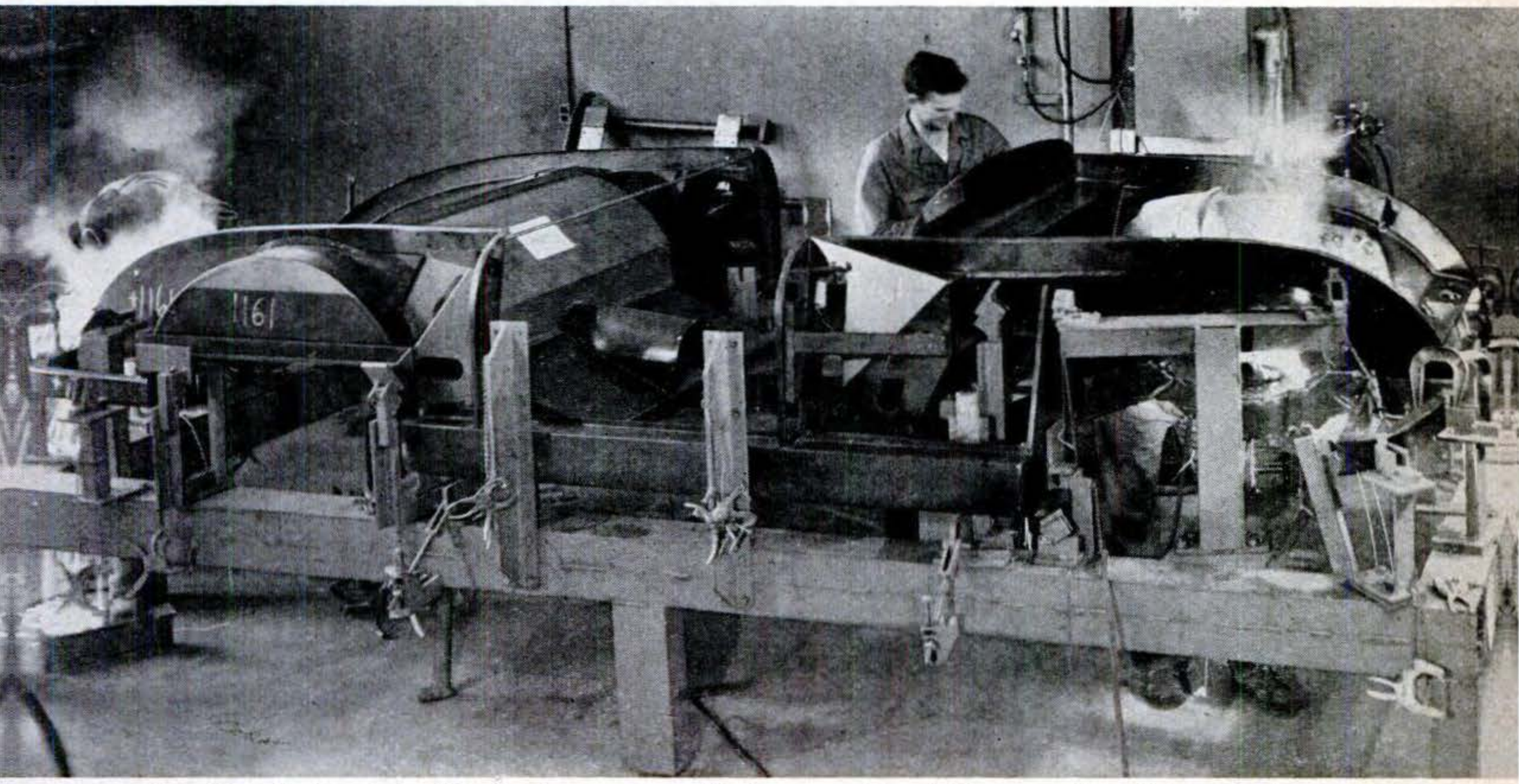
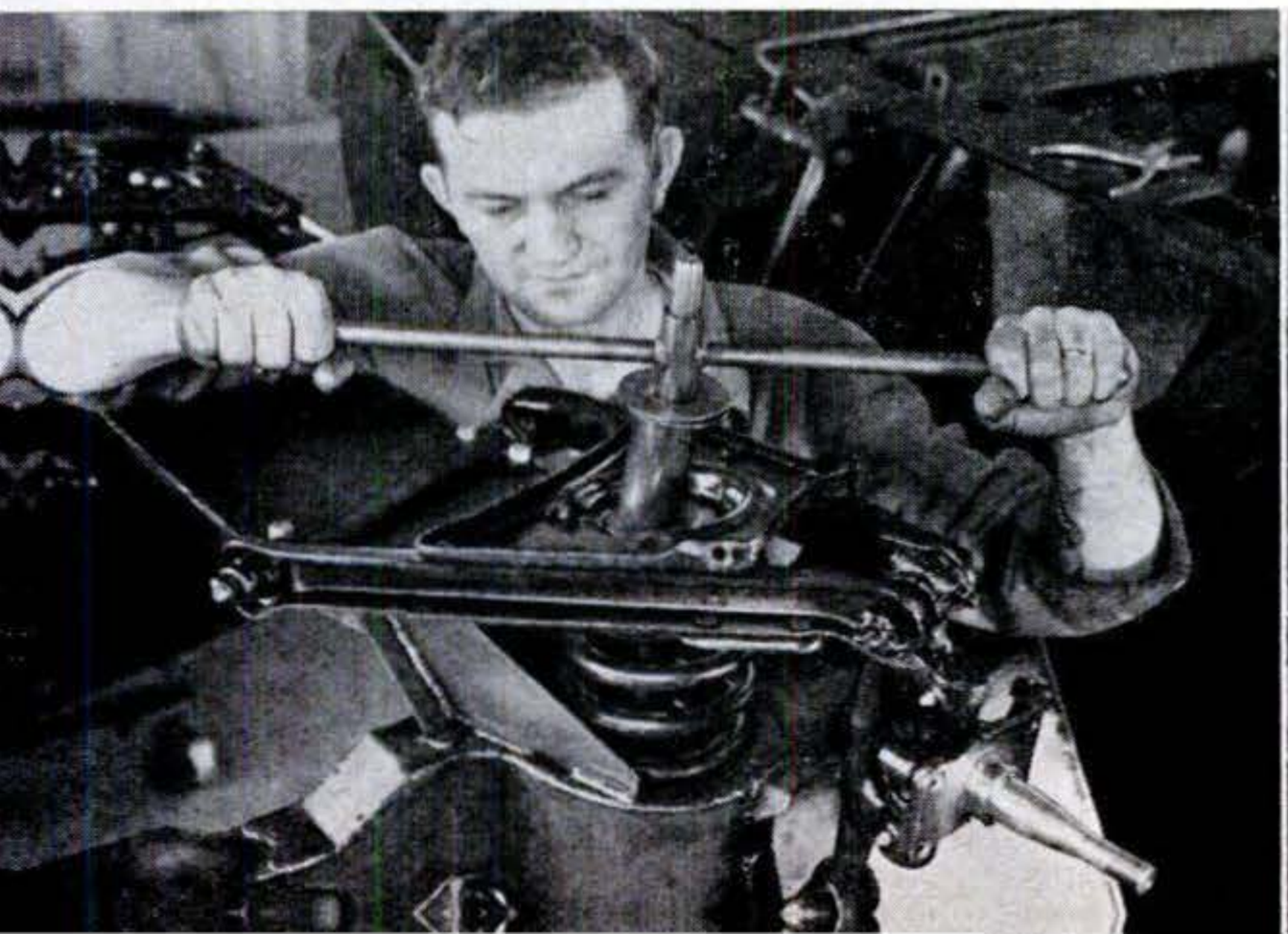


Radiator grille and full wrap-around bumpers are integral with body frame to add strength, cut over-all length. Body panels are steel and aluminum, quickly removable for making repairs.

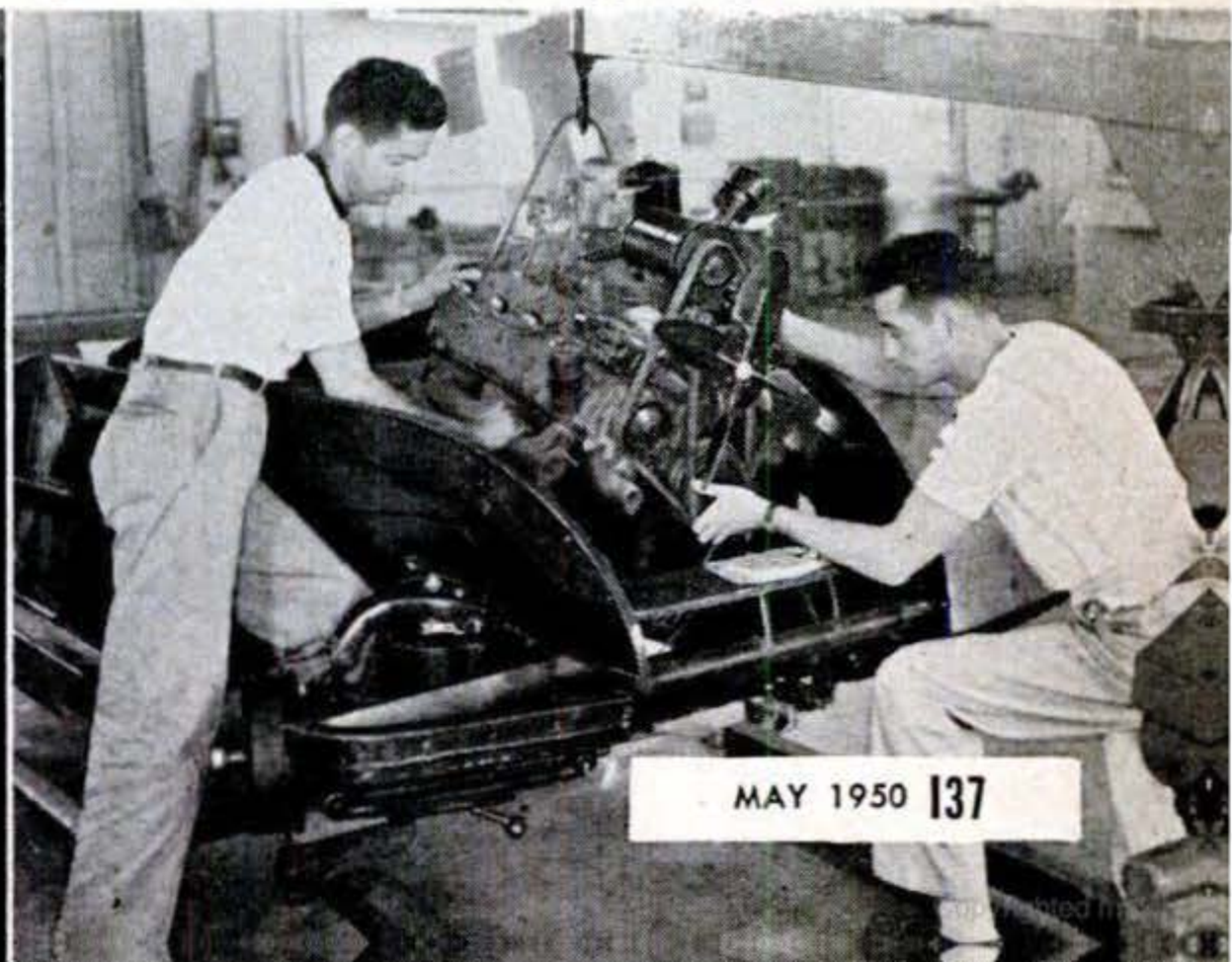
Exhaust system uses straight-through muffler. Three-port tailpipe reduces noise, gives rakish appearance. Car is 58 in. wide, 169 in. long over-all. Rear trunk has large luggage space.



Combined chassis and body frame are welded in one piece on jig. Box and channel sections provide rigid strength. This unit forms main part of basic kit and comes fully assembled.



Most subassemblies, like this front-wheel mount, make use of standard Ford parts for ease of replacement. Rear-wheel springs, also Ford, are semi-elliptics. Wheelbase is 100 in.



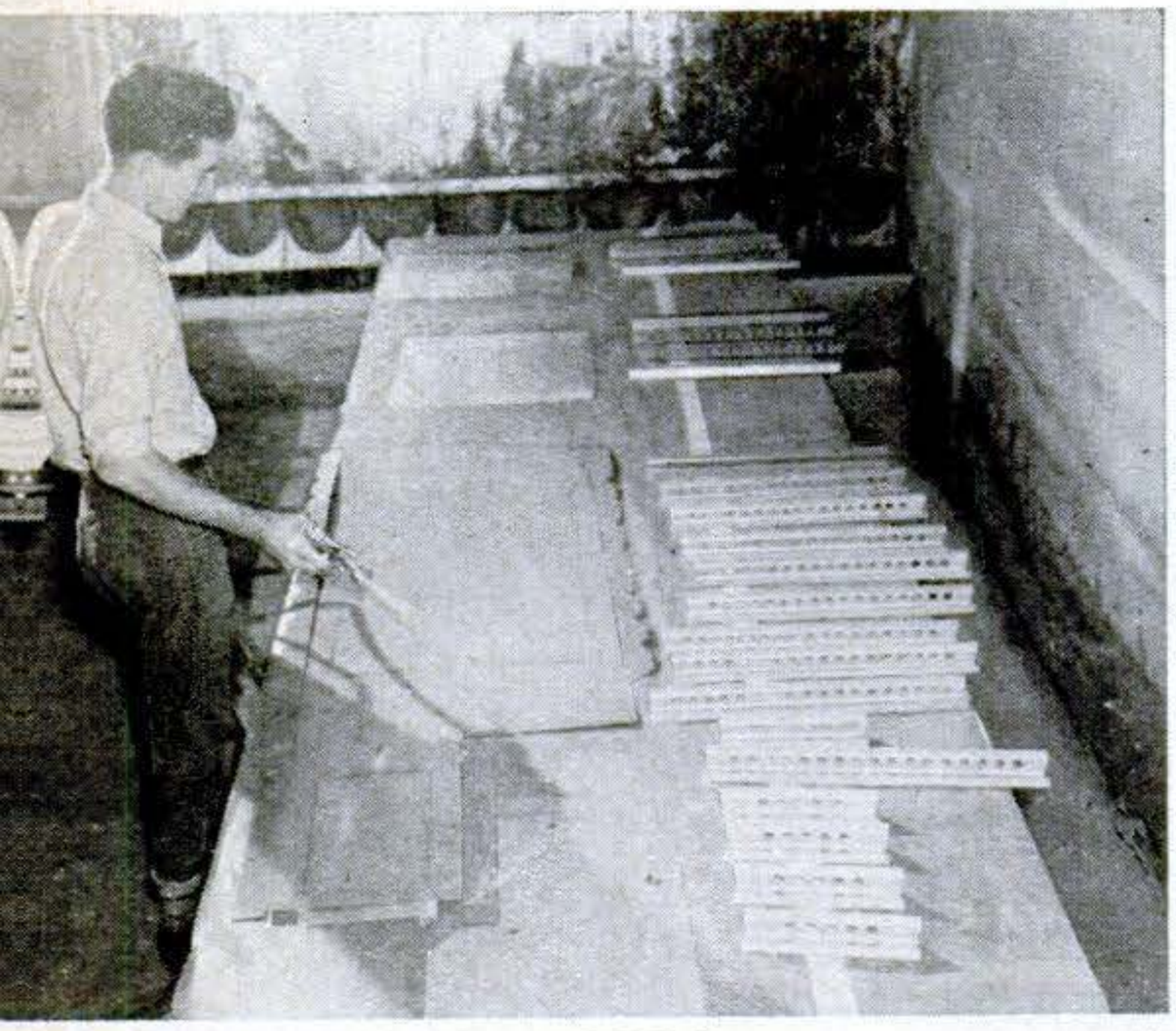
Assembly-line workers swing Ford V-8 engine into place for installation. Buick and Chrysler engines are also used. For cars intended for speed runs, special 160-hp. engines are used.

Cement Replaces Rivets in B-36

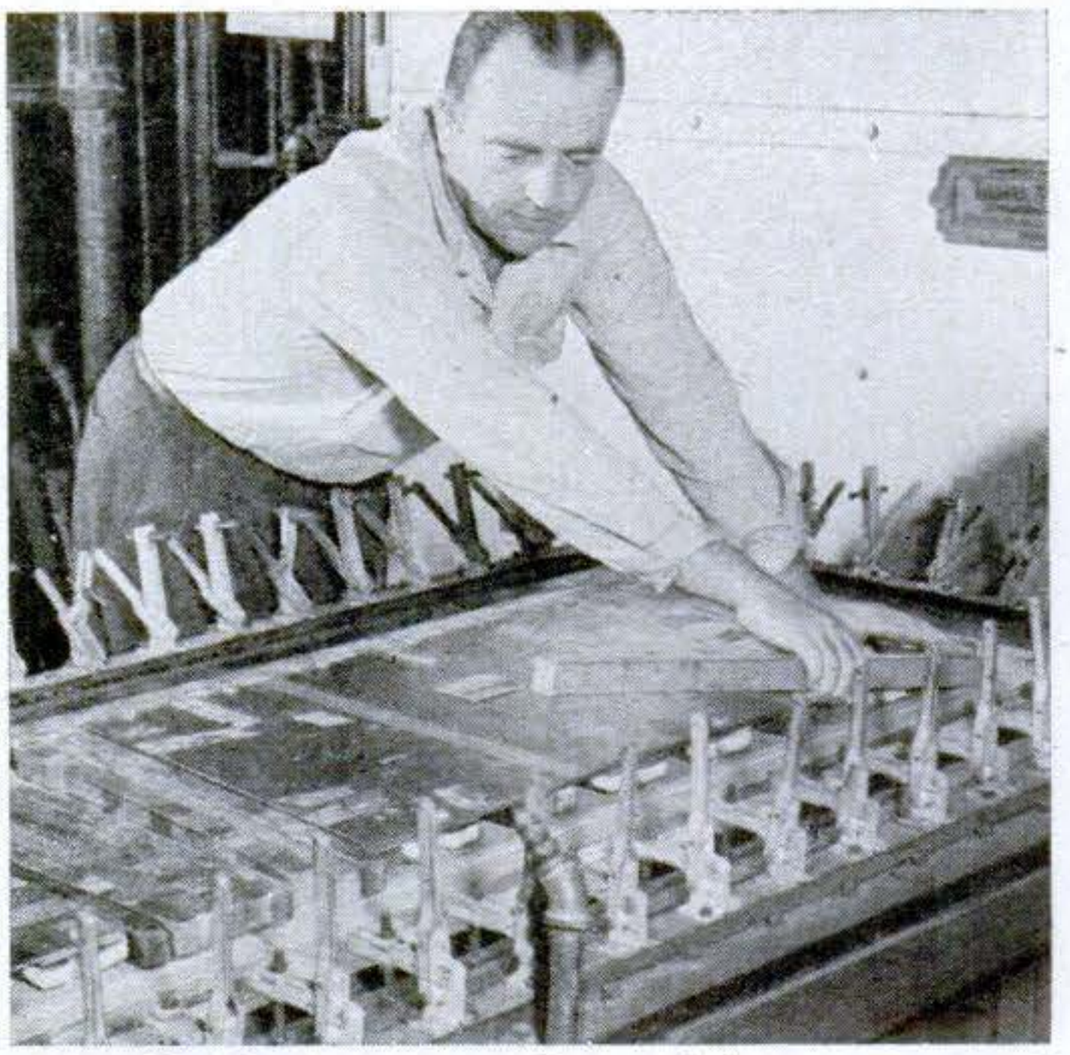
A PAIR of new synthetic-rubber compounds is taking the place of thousands of rivets in the Air Force's far-ranging B-36 bomber, saving weight and smoothing its skin. Used in Consolidated-Vultee's Metlbond® process, they stick metal parts together better than rivets or spot welding.

One cement, called M3C, is a liquid that is sprayed on the metal surfaces. The other, N2, is used on a cloth tape that fills small irregularities in the mating parts. After cementing, the assemblies are pressed tightly together in a jig and baked in a vacuum oven. While used mainly on aluminum and magnesium, Metlbond also cements other metals, wood, rubber, and some plastics.

Strip of the new sticky tape is applied to a "hat section"—a V-shaped stiffener. Tape is made by coating rolls of nylon or glass fiber with Metlbond N2 synthetic-rubber cement.

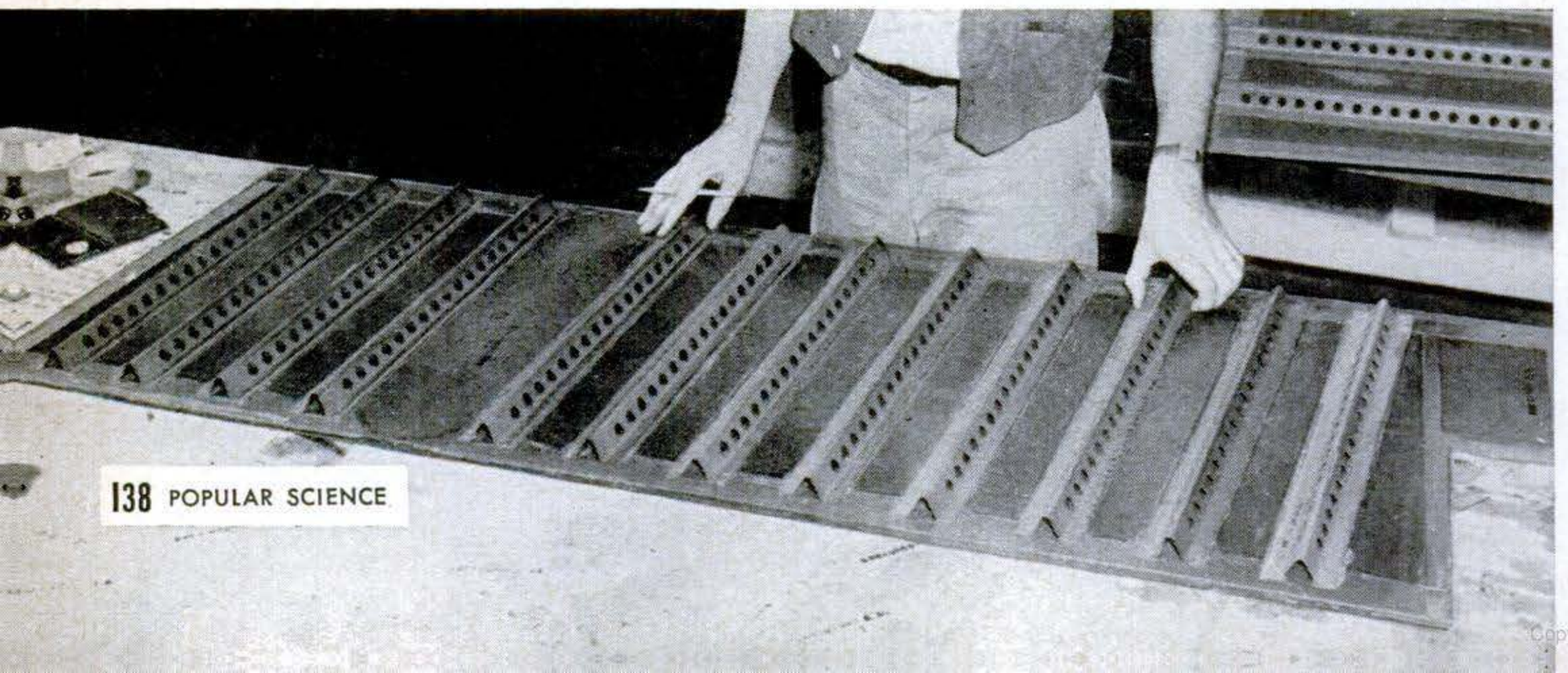


Two coats of liquid M3C cement are sprayed on a sheet-metal part before the stiffeners, already stripped with tape, are stuck in place.



Assembled parts are clamped between metal plates in jig, then enter oven for baking under vacuum. Joints attain full strength when cool.

Elevator panel for B-36 is stiffened (below) with V-shaped hat sections held in place by Metlbond cements. The only rivets used are a few needed to tack ends of the hat sections. Tests show joints 13 times stronger than riveting, 20 times stronger than spot welding.



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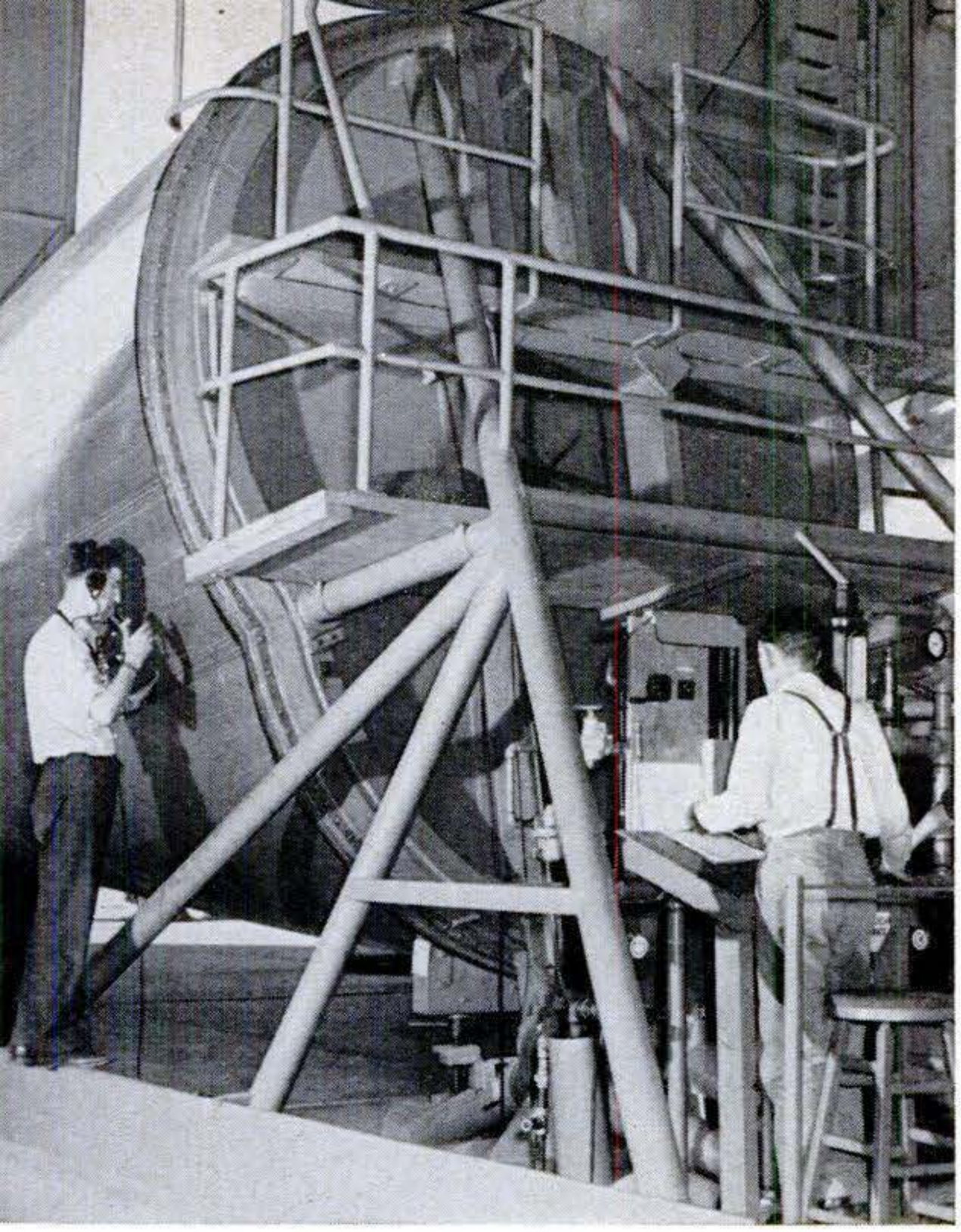
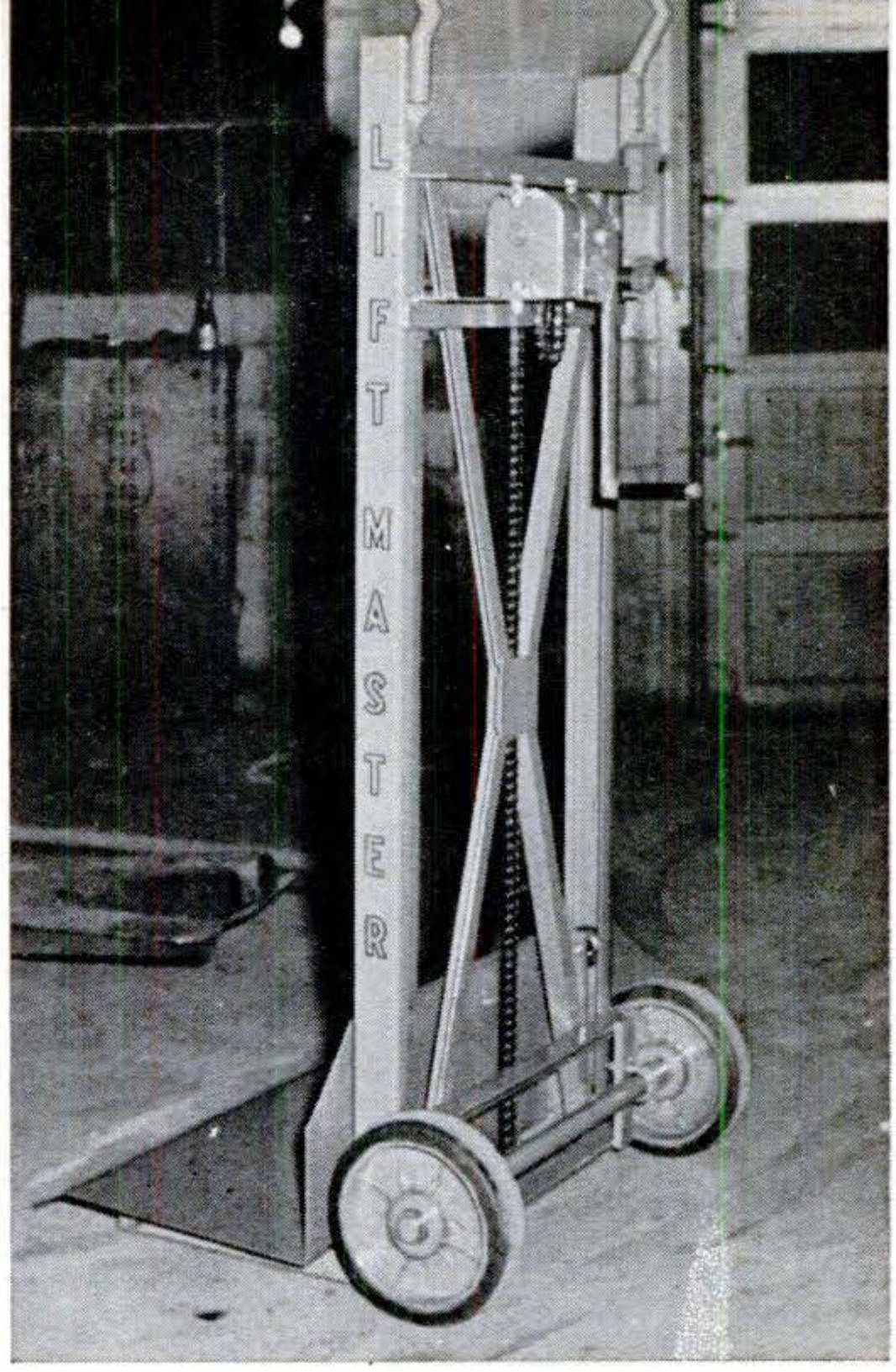


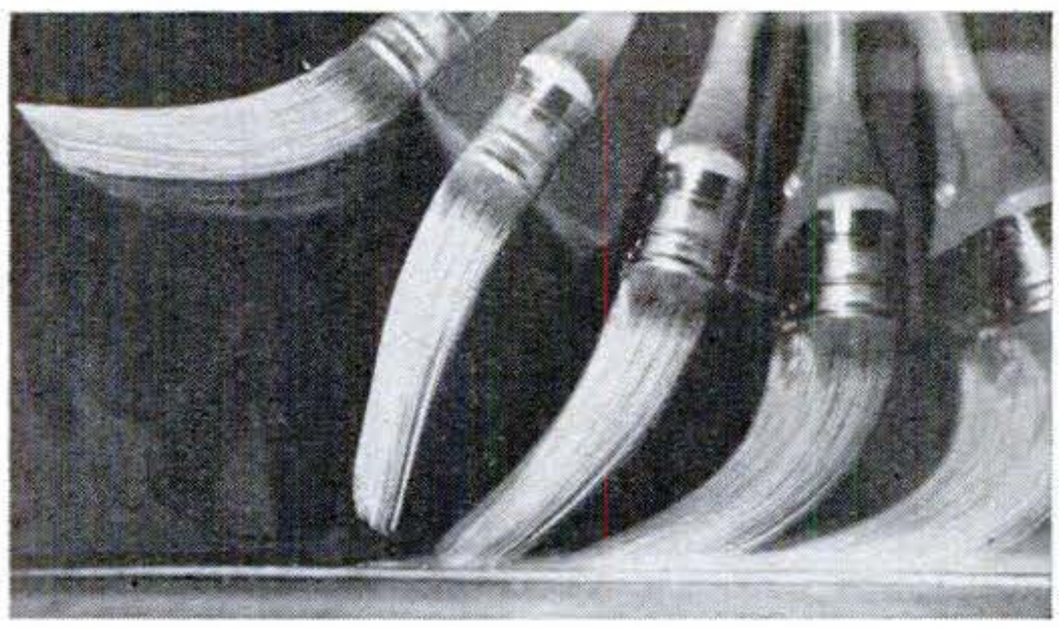
Now Cough, Please

HIGH-FLYING Stratocruisers need tough, leakproof hulls to withstand inside pressures required for comfortable high-altitude flight. To find out how well a fuselage holds air, technicians at Ryan Aeronautical Co. pump them up and listen for leaks with physicians' stethoscopes. It takes four days to put on the pressure, using setup shown above.



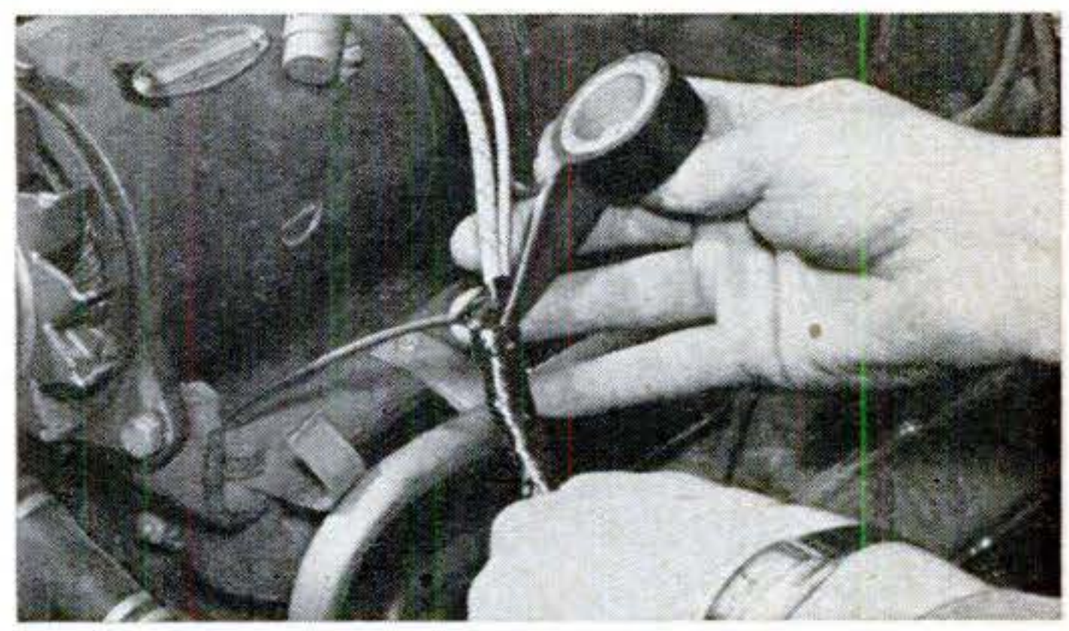
Hand Truck Also Lifts

THIS heavy-duty hand truck lifts the load, too. When the Lift-Master® is standing up straight, as in the photo above, a hand crank can raise a 500-lb. load as much as four feet. With the platform in the "down" position, it carries boxes and crates just as a standard hand truck does. Leigh Industries, of Royal Oak, Mich., is the manufacturer.



Strobe Photo Tests Brush

THAT'S just one brush above, caught in five positions as it made a single painting stroke. The picture, made with high-speed stroboscopic flashes, indicates the springiness of the nylon bristles. Engineers at Arthur D. Little, Inc., research consultants, used this method to evaluate new brush types for a paintbrush manufacturer.



Plastic Tape Insulates, Protects

A PLASTIC tape that serves both as electrical insulation and abrasion protection is now being used by automobile repairmen. It saves the time and space formerly needed to apply first rubber tape, then friction tape. The tape resists water and chemicals, and sticks to almost anything. Scotch Electrical Tape®, is not yet on sale to consumers.

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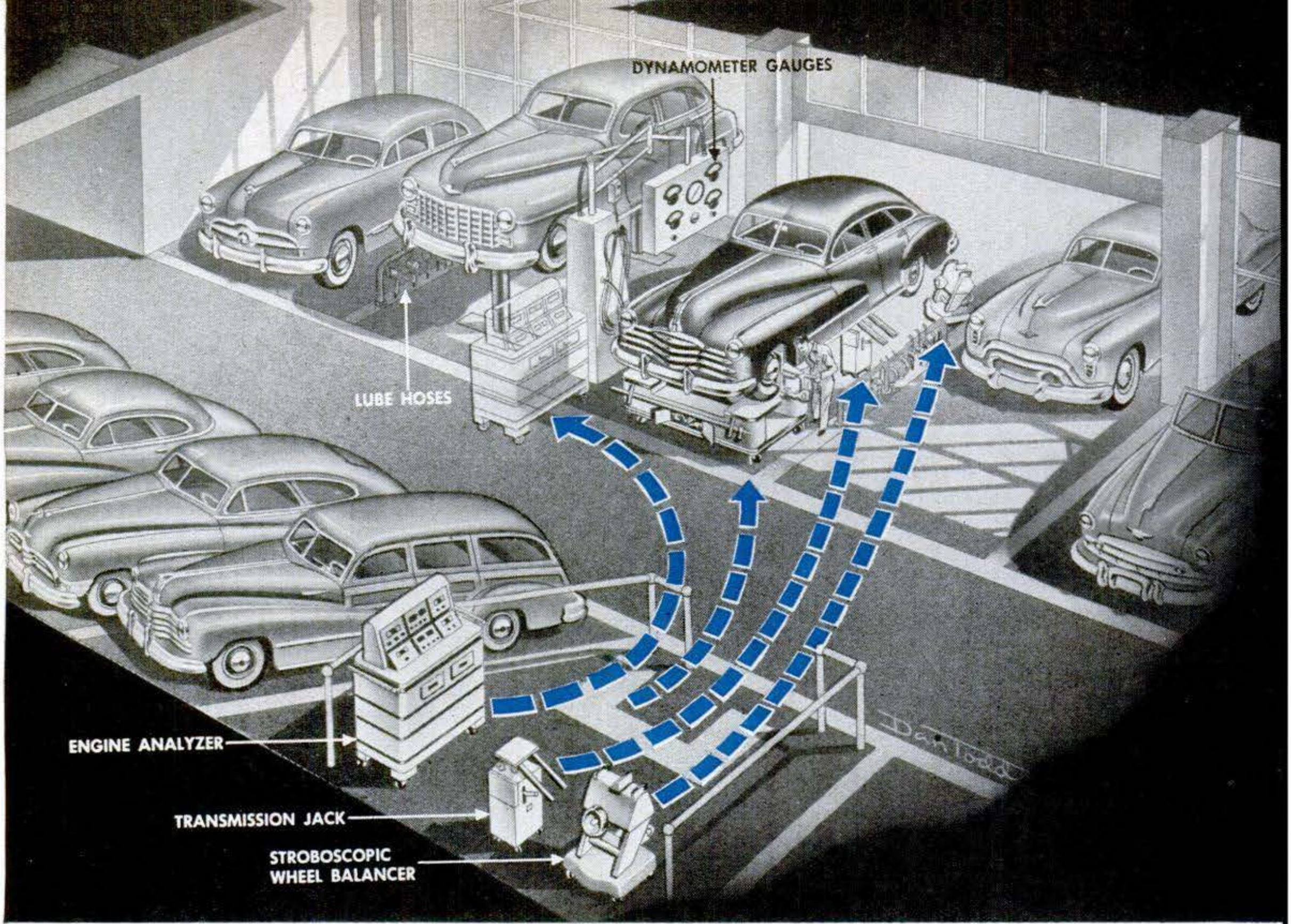

"Sick cars" in this New York repair station are assigned hospital space, and test equipment and tools are moved to them. The only piece of equipment that isn't mobile is the dynamometer.

New Clinic Gives Cars Family-Doctor Care

Staffed with Gus Wilsons, this place is a multiple one-man shop, where the customer talks with his own mechanic.

By James Poling

PS Photos by Hubert Luckett

TAKE a dozen or so one-man auto repair shops, locate them side by side under one management, and you've got something new in service stations.

This, in effect, is what you'll find at a big shop recently opened in New York City. Every man who works there is an all-around mechanic, well qualified to give Gus Wilson a run for his money.

As Charles Schnurmacher, who likes to think of his new $750,000 Manhattan Pontiac shop as an "automobile clinic," explains it:

"Our mechanics are like 'family doctors. They can do everything for a car that a car requires, and they deal directly with the customer."

Unlike most big shops, this one has no service salesmen or order takers. When you drive in, an inspector-mechanic meets you on the apron. The same man stays with your car until the job is finished. You must deal with only one other person—the cashier.

The shop is laid out so that work can be done without moving the car about or handing the job on from person to person. The equipment is the same as that available to any other service station, but it is used in a way few other shops do.

This is not by accident. Schnurmacher, with 25 years' automobile experience, is also head of an older, conventional service station in New York City. There he long ago learned that every repair-seeking customer

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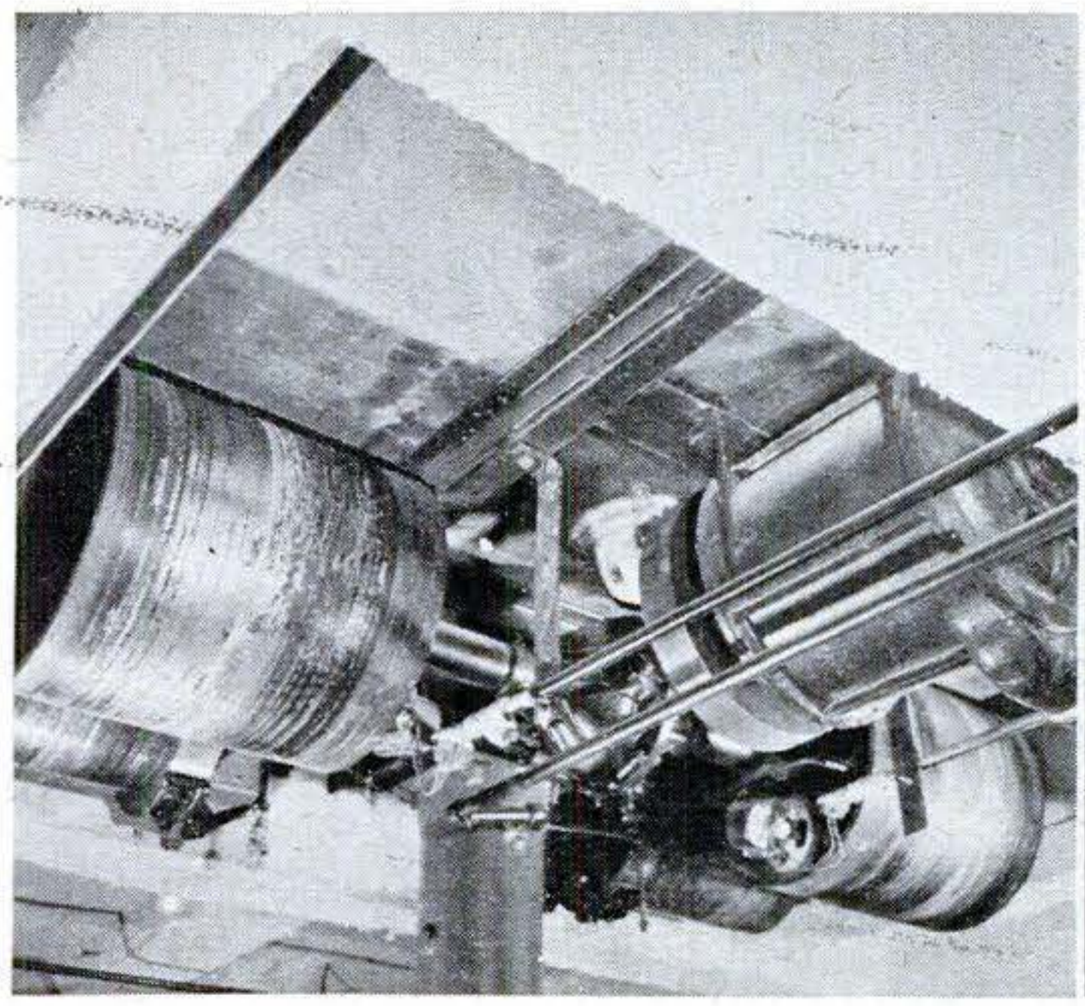
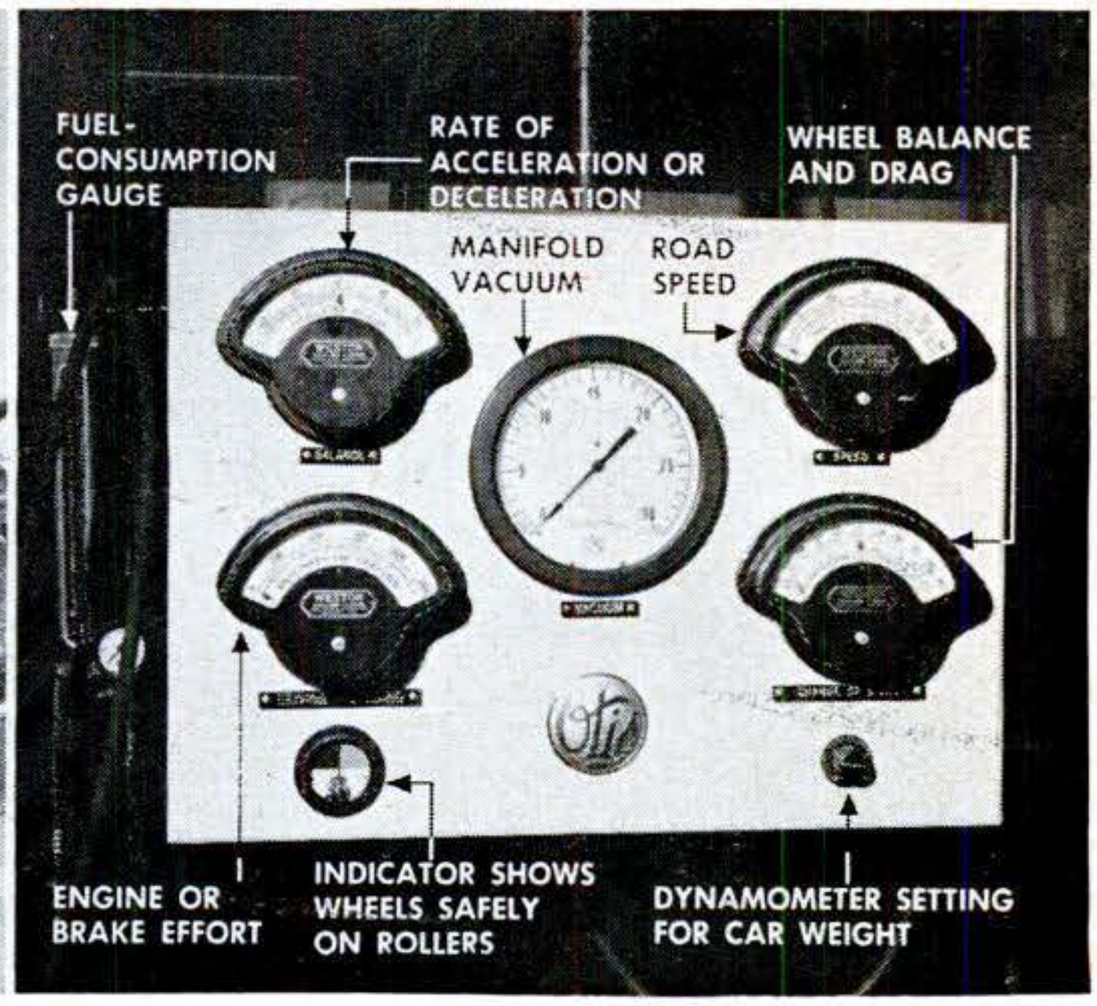
Racing at 50 m.p.h. on Otis proving stand, a dynamometer simulating road conditions, car tells its story to mechanic. Test may detect ailments owner didn't report, simplifies diagnosis.



Here's bottom view of roller-beds on which car's rear wheels spin. Rollers are connected to a differential coupled to 135-hp. dynamometer. It simulates various speeds and loads.



These instruments constitute the thermometer and stethoscope of an automobile doctor. Shop's nine service bays contain almost everything mechanic needs except mobile equipment.

is always "in a helluva hurry." Knowing that full cash registers sprout from pleased customers, Schnurmacher analyzed operations at his old shop. He concluded that overspecialization among mechanics and the constant need to shift cars about were voracious time-consuming elements. Then he set out to build his "dream" station.

It took him a year to acquire a piece of property on New York's Eleventh Avenue that, by fronting on three streets, fulfilled his specifications. This per-

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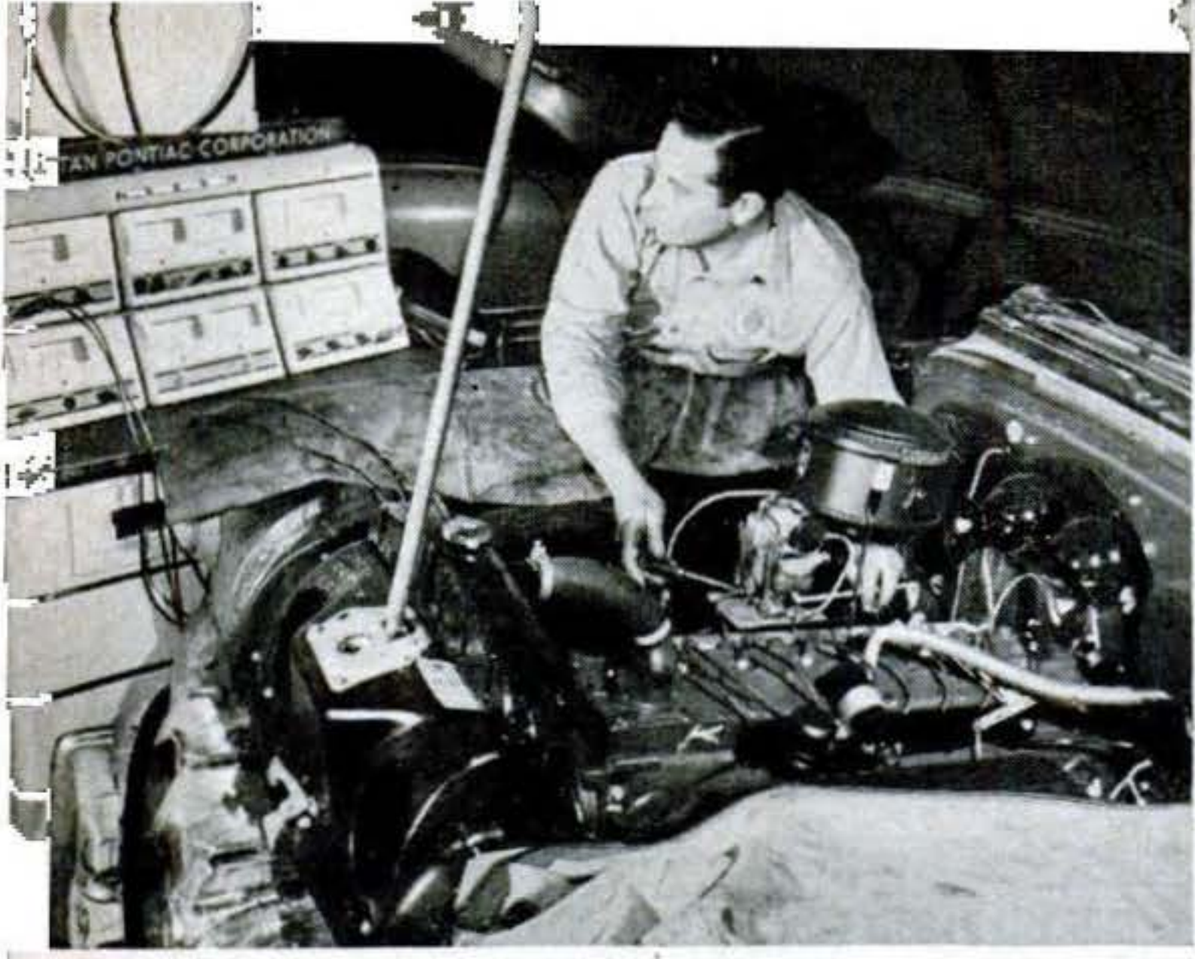
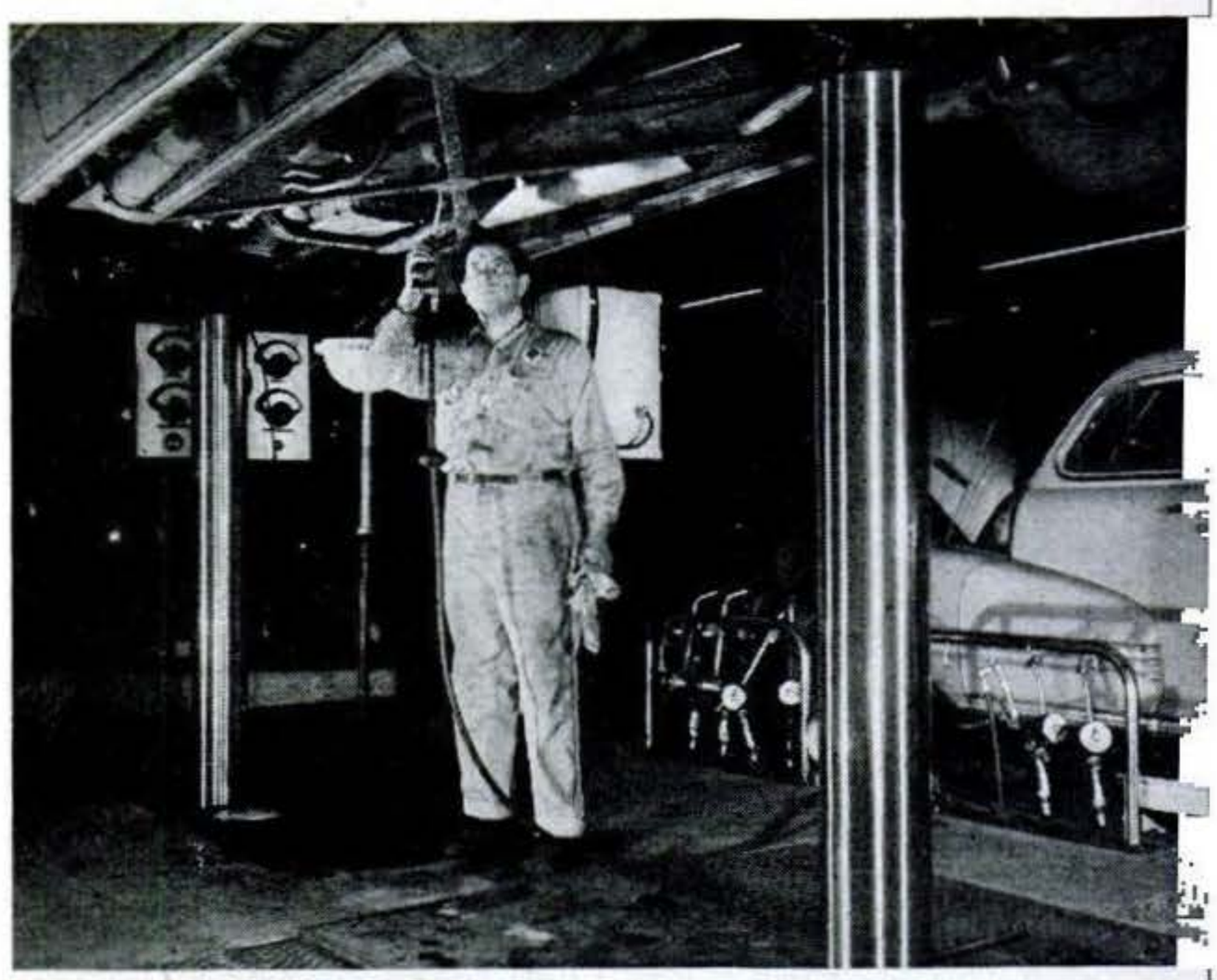


Engine analyzer helps mechanic set timing on a distributor. Analyzer also checks coil, condenser, fuel-pump pressure, generator regulator, and carbon monoxide in exhaust.

Stroboscope balances chalk-marked spinning wheel. Pulse switch flashes light as heaviest part of wheel passes. Speed is then set to "stop" chalk mark, locating spot for balance weight.

mitted each of his repair bays to open on the street. He called in George P. Saladino, an experienced service-station engineer, who spent six months in laying out the plant and in selecting equipment. He adhered religiously to Schnurmacher's ruling, "Don't move the car. Bring the equipment to it."

When construction was completed Manhattan Pontiac had a steel and concrete building with tiers of windows, cream-colored, interior walls of tile, a shadowless fluorescent-lighting system, and nine repair bays, each complete with expandable twin-post hydraulic lifts, built-in floodlighting, and a unique ten-hose lubricating system. The building fronts on a 40-foot by 200-foot service apron. Counting the basement stockroom, the street floor and second floor (each of which can accommodate 50 cars), and the paved roof, with storage space for 80 cars, the building totals 55,000 square feet.



Repair bay has rack holding hoses dispensing water, air, two types of chassis lubrication, two types of transmission grease, three types of motor oil, and oil used in automatic transmissions.

Mechs Are De Luxe, Too

Manning this station and serving customers ranging from the ordinary guy to notables like radio's Ted Husing and the Metropolitan Opera's Ferruccio Tagliavini are a group of specially selected mechanics. Schnurmacher calls them "the highest paid in the business."

All of them have had at least 12 to 14 years of repair experience. A new man must first undergo an examination. "How do you adjust a rear-end pinion?" is about the simplest question he will encounter. If he passes the exam he is then sent for a month to Schnurmacher's earlier, conventional service station. The idea is not only to find out if he is a qualified workman, but also to learn if he has the personality to deal directly with customers.

Whether or not these are the highest-paid mechanics in the auto-repair business (some average $150 a week), they are certainly among the most contented. During a 15-minute morning break—for which the company provides coffee and cake—senior mech Harry Baker said, "Imagine a mechanic that's never on his back, with everything he needs within arm's reach, or else conveniently mounted on wheels! This place is the last word."

Charles Jordan, the service station's ruddy-faced manager, says, "Baker's too enthusiastic. I've been in this business 31 years

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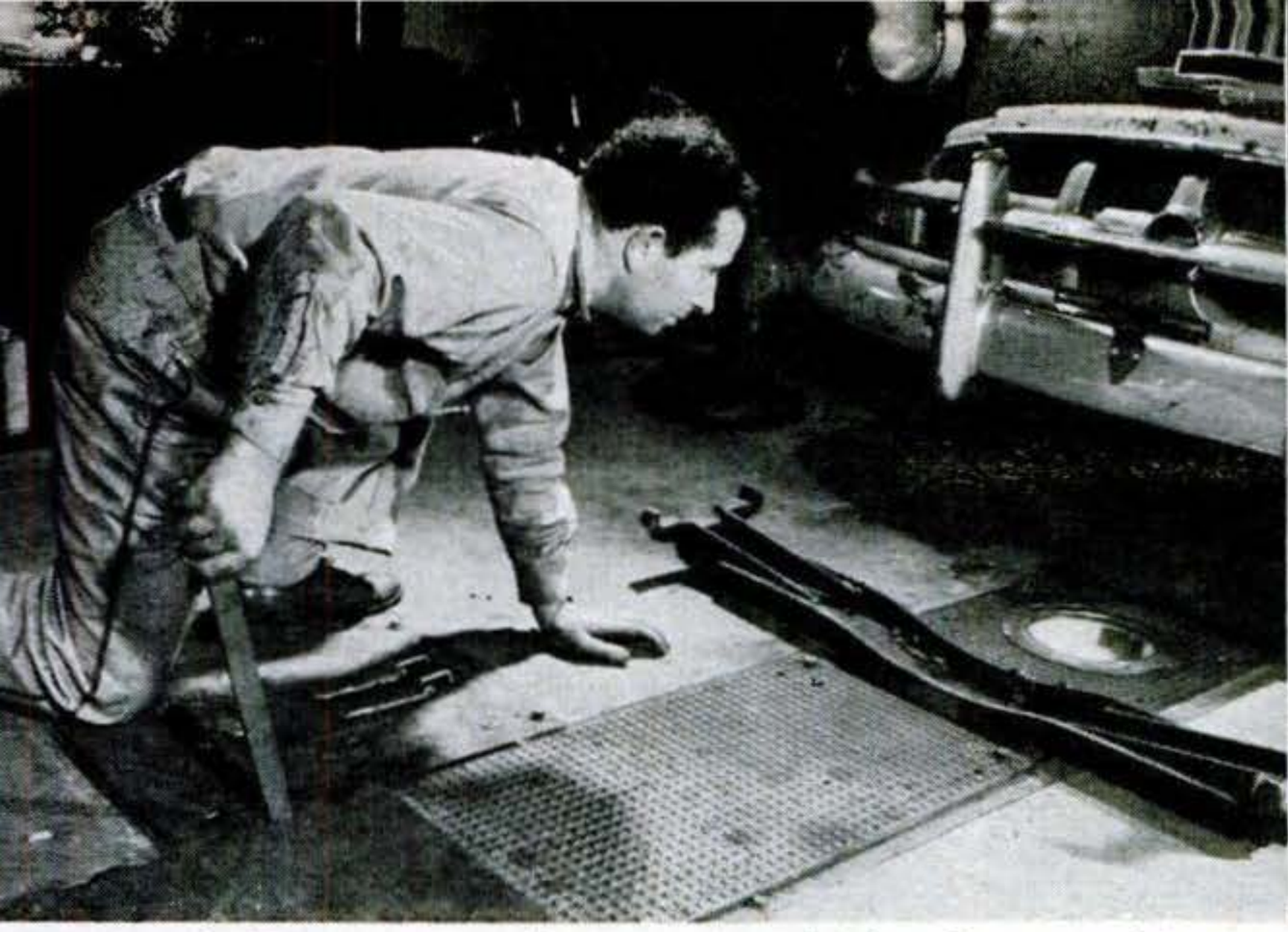
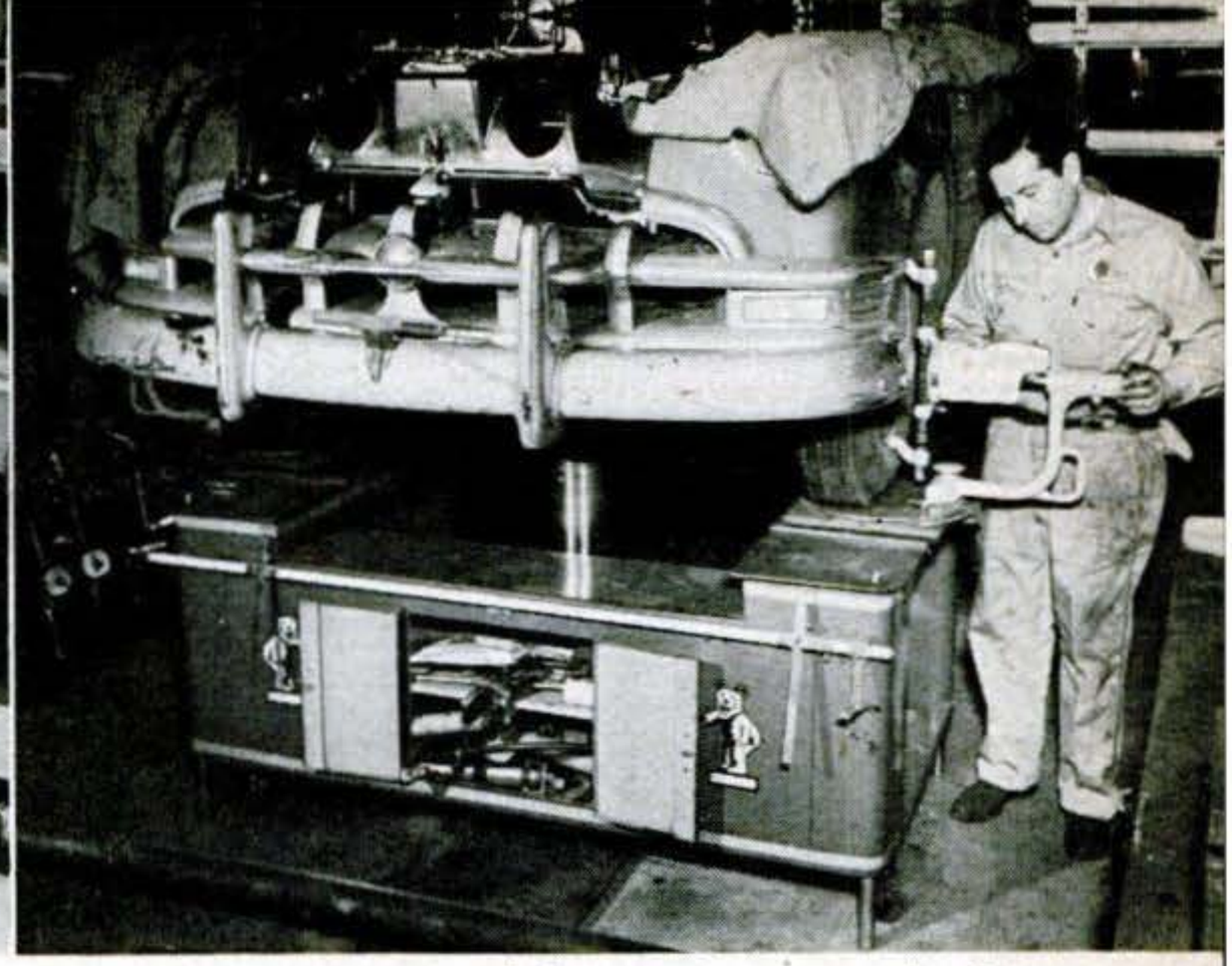
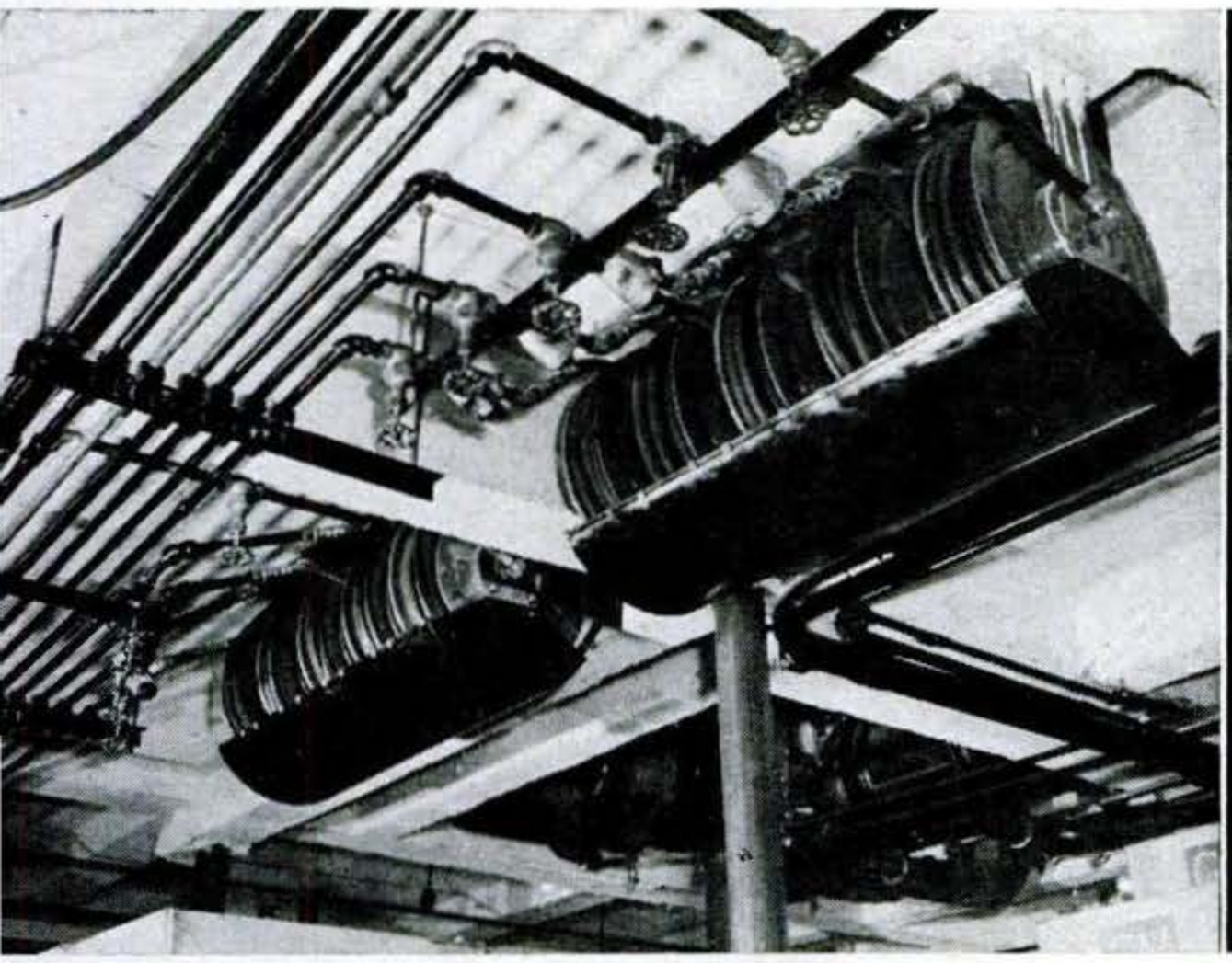


Front ram of a Weaver hydraulic post lift is moved into position to lift car's front end. This is said to be first time an expandable lift has been built into a dynamometer setup.



This machine is used for an accurate check on front-end alignment. It not only reveals whether camber and caster are incorrect but detects any other faults in car's steering geometry.



Lubricants are carried in pipes under air pressure to flexible hoses housed in reels. They flow at the press of a finger and each hose has a gauge showing quantity used.

Special transmission jack is used by mechanic to remove heavy Hydra-Matic transmission. Two arms leading from supporting face of jack serve as "gangplanks" to ease unit onto workbench.

and I know there's never a last word. Someone always dreams up a new gimmick. But they're going to have to do some pretty tall dreaming.

"Customers always ask the impossible, and we come about as close to achieving it as you can with present-day equipment. There are bigger service stations, with larger staffs, that can't put cars through the works as fast as we can."

It may not be the last word, but this shop has already caused enough excitement in the trade to have drawn to it, for study and admitted imitation, automobile people from as far distant points as India, Brazil, Lebanon, Colombia, and Turkey.

Curiously enough, the visitors have been particularly impressed by the fact that even the required-by-law, sand-filled fire buckets are mobile. What they haven't been told is that for all the careful planning, no provision was originally made for fire-bucket hooks. This oversight was discovered only after the walls had been tiled.

So Schnurmacher went down to New York's wholesale garment district and got hold of several of the caster-mounted racks on which dresses are hung and moved about in the garment industry. Each one now supports a half-dozen fire buckets, and can be quickly trundled to the scene if a fire should blaze up. END

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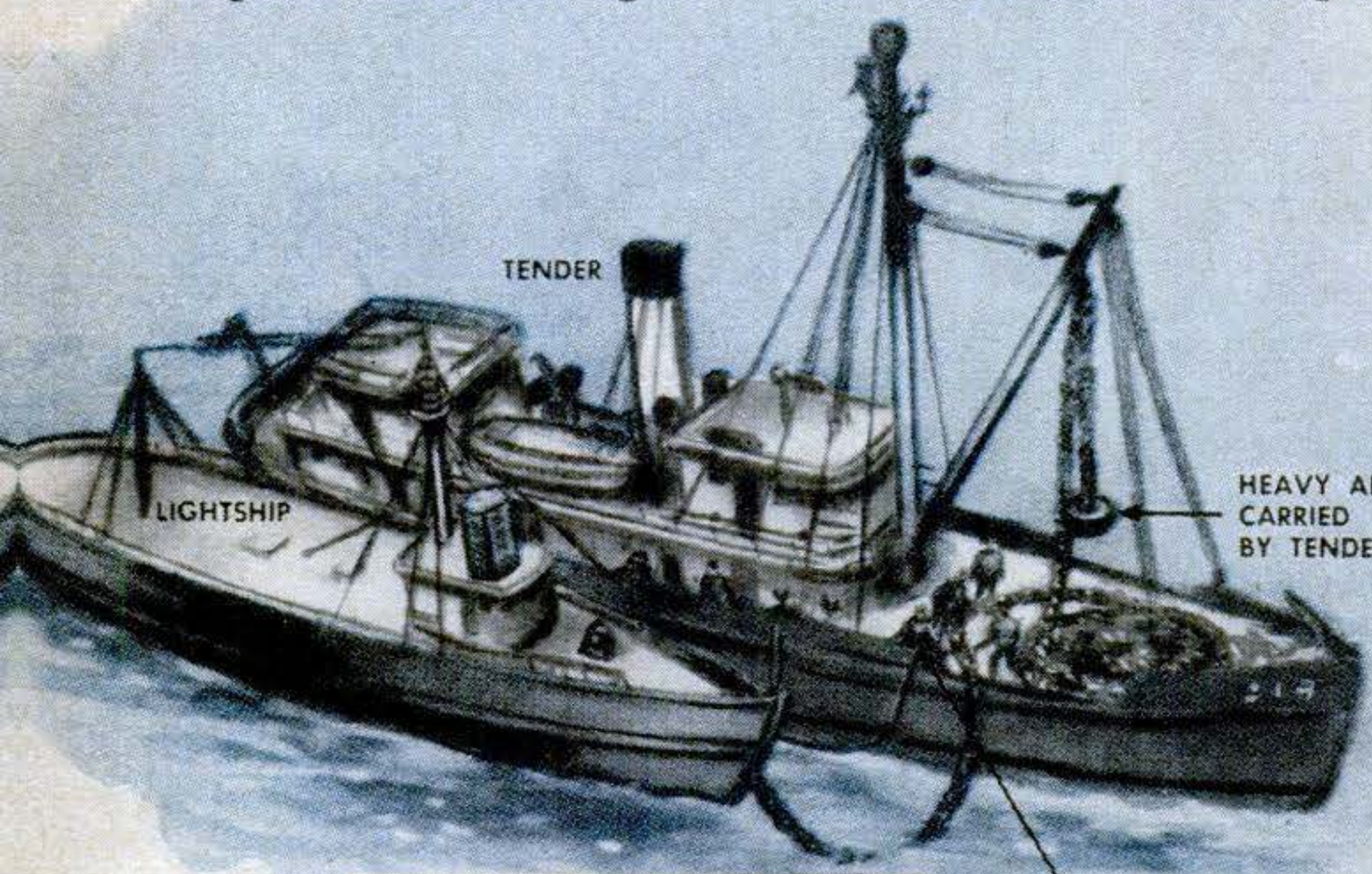
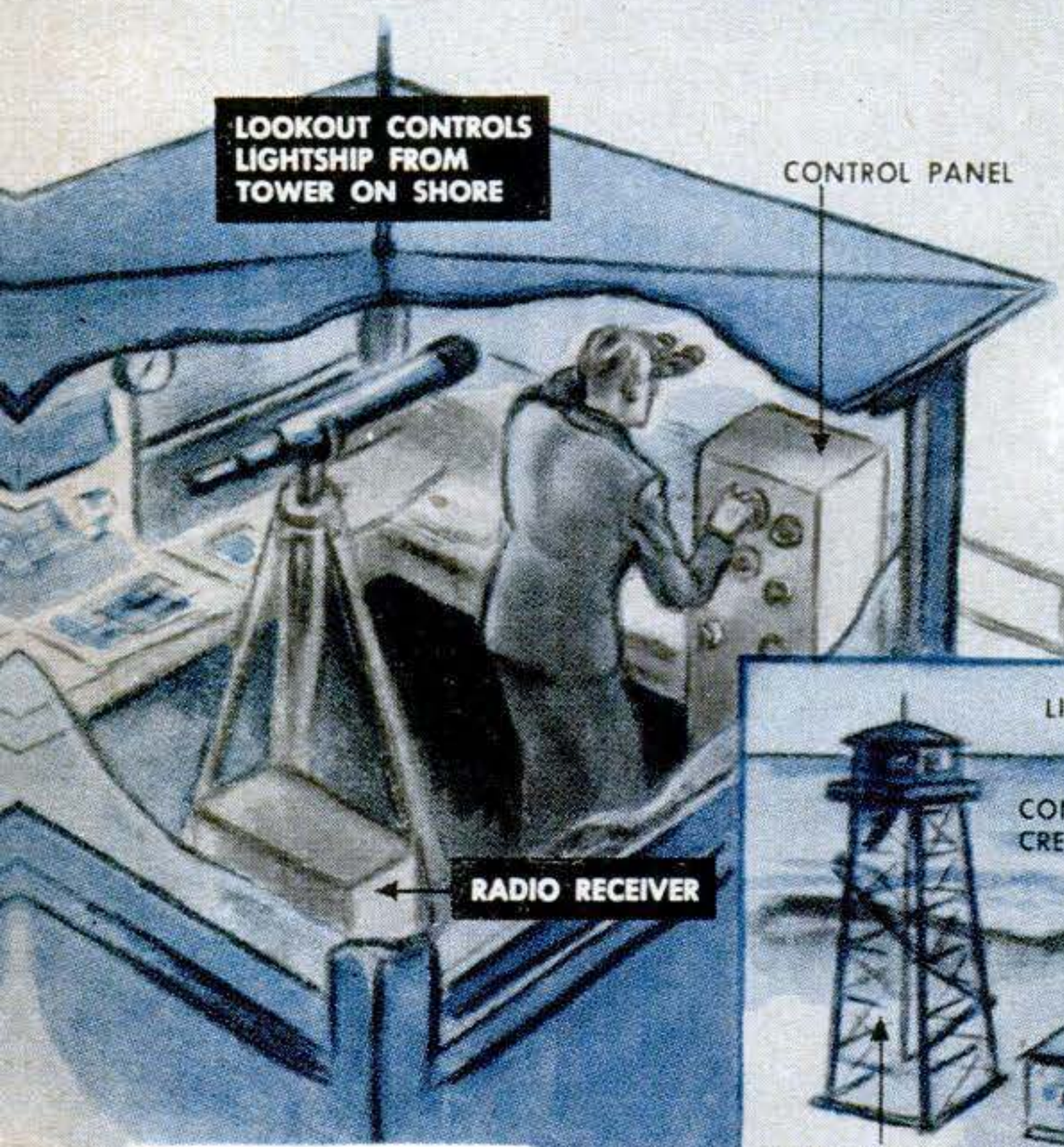
Electronic "Crew" Mans Lightship

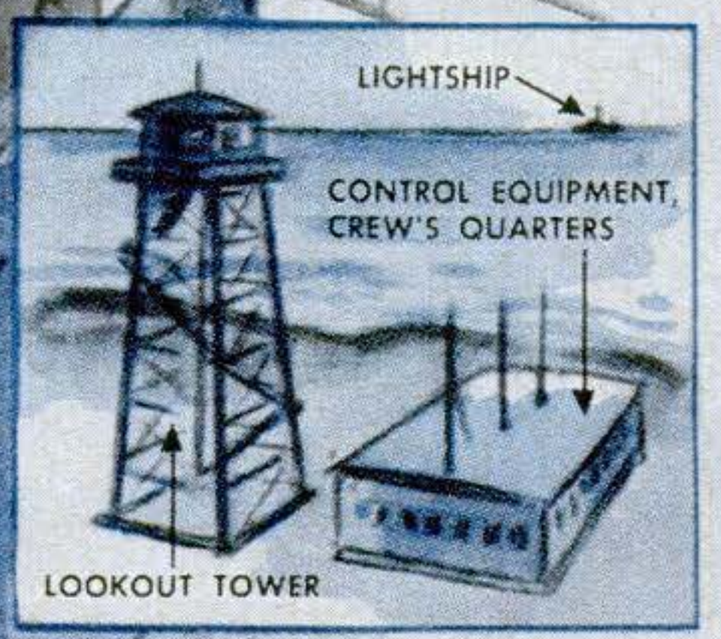
A DESERTED ship will soon stand guard over the southern approaches to New York Harbor. An experimental new Coast Guard lightship, named the *Exp*, it is completely unmanned. Instead, it has a "crew" of electronic devices operating automatically or controlled by radio from shore. Each of its signals—marker light, foghorn, radio beacon, and bell—is either duplicated or otherwise arranged to defy failure. If either main light fails, the other keeps operating; if both fail, there's still an emergency battery light. Three Diesel generators work in rotation to supply power. If one quits, another automatically takes over. Cost of the new ship is $375,000—just half the $750,000 of a manned lightship. An annual saving of $59,000 in maintenance and personnel is also anticipated.

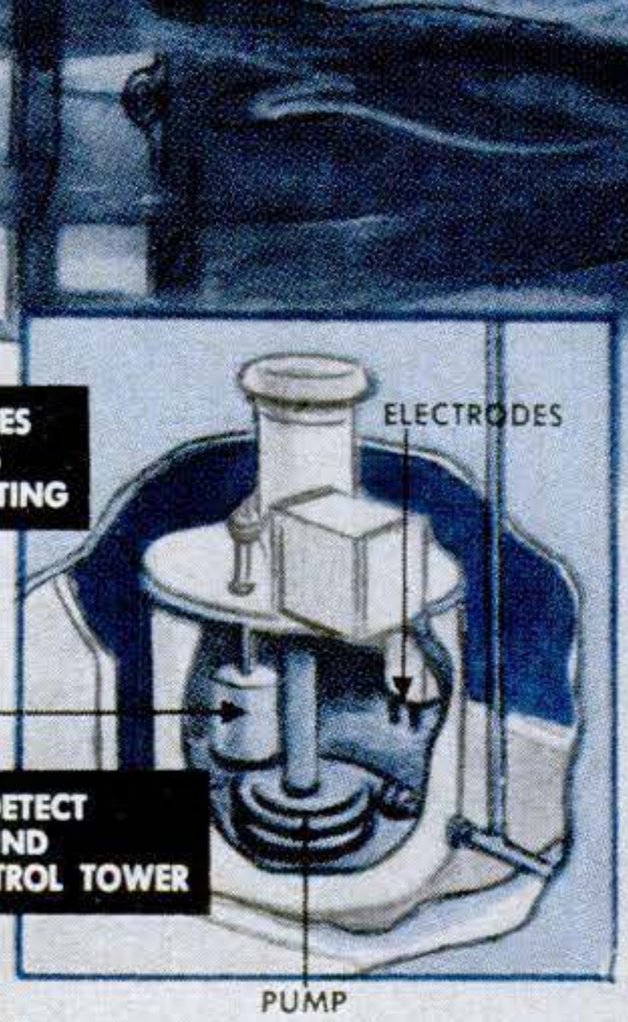


TENDER TOWS UNPOWERED LIGHTSHIP TO STATION, DROPS ANCHOR



LOOKOUT CONTROLS LIGHTSHIP FROM TOWER ON SHORE





RISING WATER RAISES FLOAT THAT STARTS BILGE PUMP OPERATING

ELECTRODES ALSO DETECT RISING WATER, SOUND WARNING TO CONTROL TOWER

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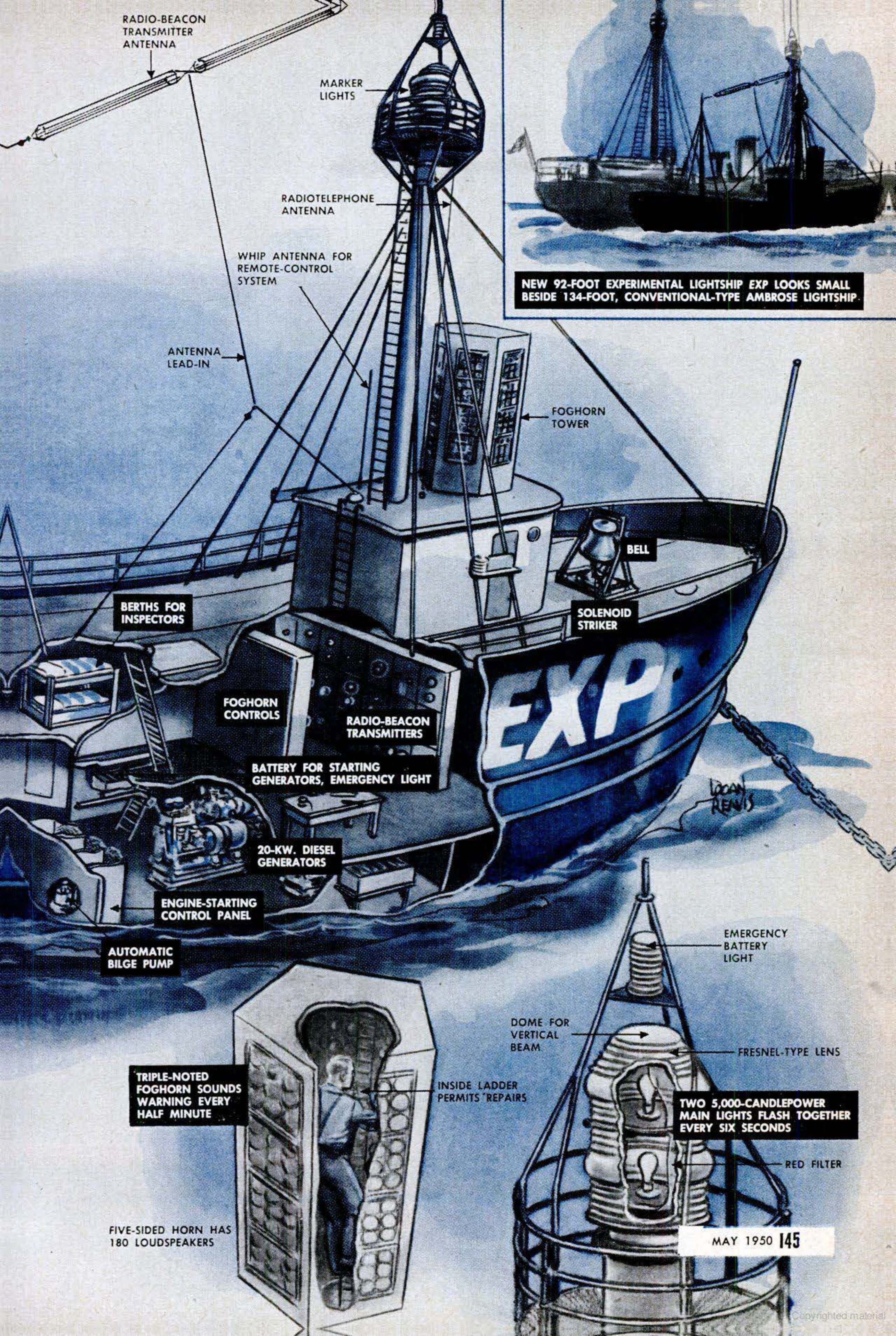

NEW 92-FOOT EXPERIMENTAL LIGHTSHIP *EXP* LOOKS SMALL BESIDE 134-FOOT, CONVENTIONAL-TYPE AMBROSE LIGHTSHIP

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New Du Pont desks provide private work space in area that was formerly noisy open office.

Desk and Office Built in One Unit

OFFICE furniture is one of the few things the Du Pont Company does not make. But, faced with the problem of getting more comfort and utility out of big, open "bull-pen" offices, the chemical concern's engineers tried their hands at that, too. And they came up with an unusual desk unit that is a whole semi-private office for one man. The units fit together to convert the noisy bull pens into quiet, individual offices.

Each unit consists of an L-shaped shelf—the desk—to which bookshelves and partitions are permanently attached. Lengthening the L are two desk-height filing cabinets, each carrying its own partition. By lining the Ls up, only one side remains open.

The units are so attractive that seven furniture companies have begun making them from the Du Pont designs. Du Pont is still keeping out of the furniture business.

L-shaped shelf-desk is foundation of the whole "office." Support posts, fastened directly to its corners (top, left), hold the partitions (bottom, left), which may be of glass or other material. Whole office unit can be easily moved.

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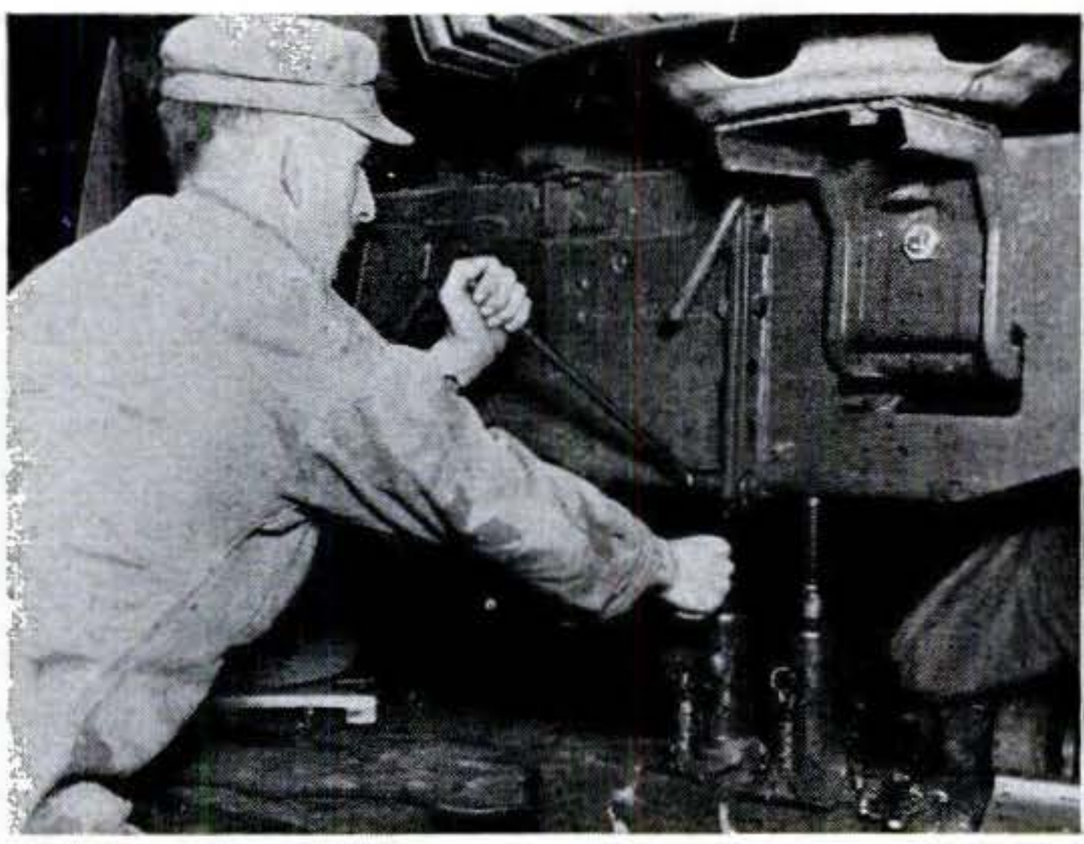
Army 2½-ton truck before the paratroopers start tearing it down for stowage aboard a plane.

Army Splits a Truck in Two

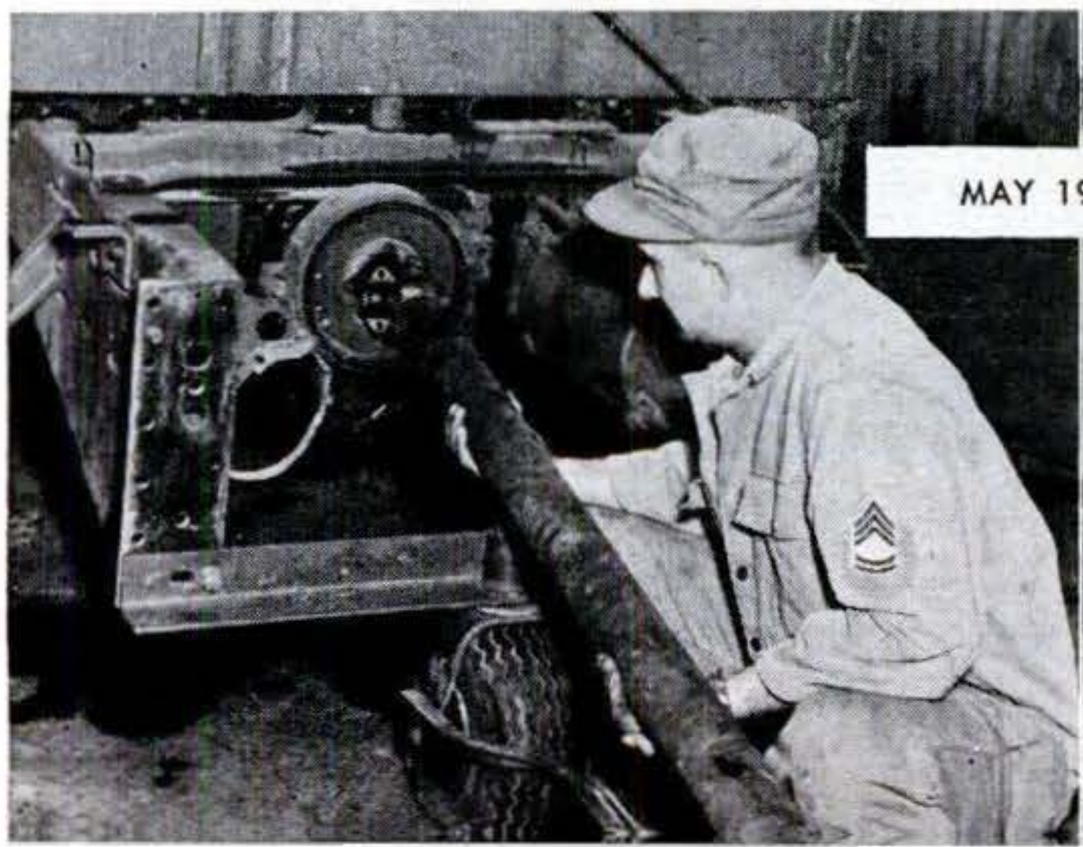
THE Army's 2½-ton truck is a pretty solid piece of equipment. But the type shown above is different. To ride in aircraft with airborne troops, it has to come apart.

After the frame has been cut just behind the cab, tie plates are welded to each of the frame halves and bolted together for normal use. To break down the truck for loading on a plane, as pictured below, the frame is unbolted, propeller shafts removed, and wiring, gas line, and brake lines disconnected. With a dolly supporting the rear of the cab, the front part of the truck moves under its own power. An auxiliary gas line feeds from a 5-gallon can carried on the running board.



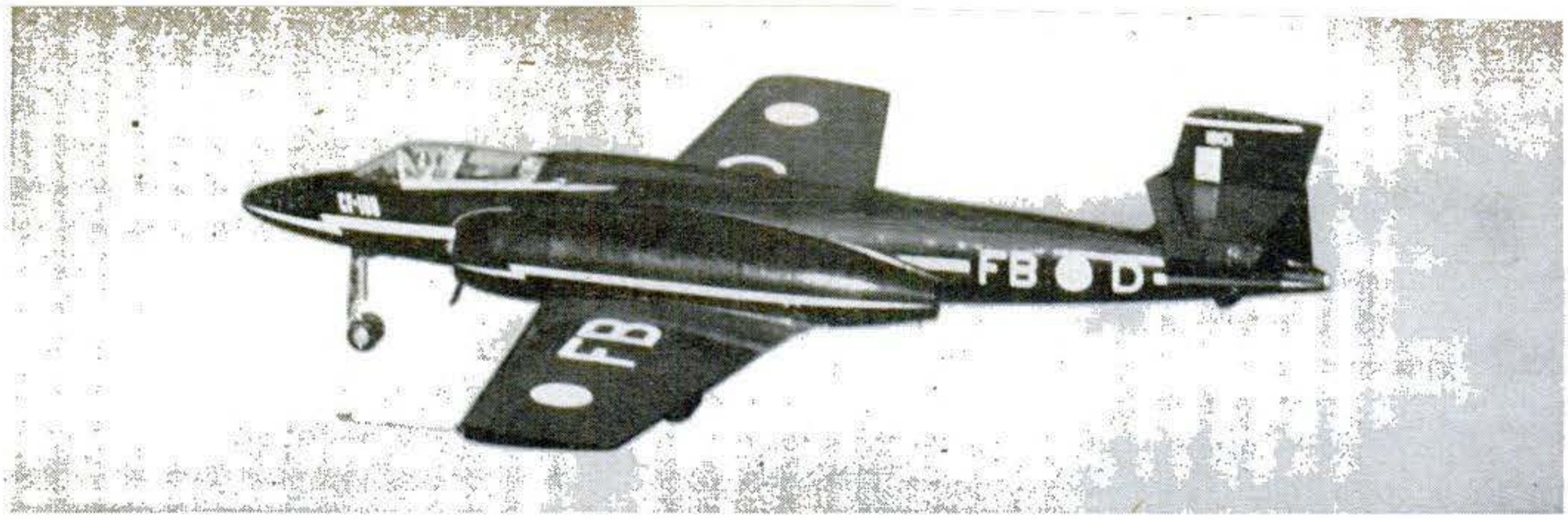
Each half of the split frame is supported by a hydraulic jack. Then the tie-plate bolts that hold the two sections together are removed.

Angle iron to which dolly is attached is bolted to tie plates on front half of frame. Dolly bears load so truck can drive under own power.



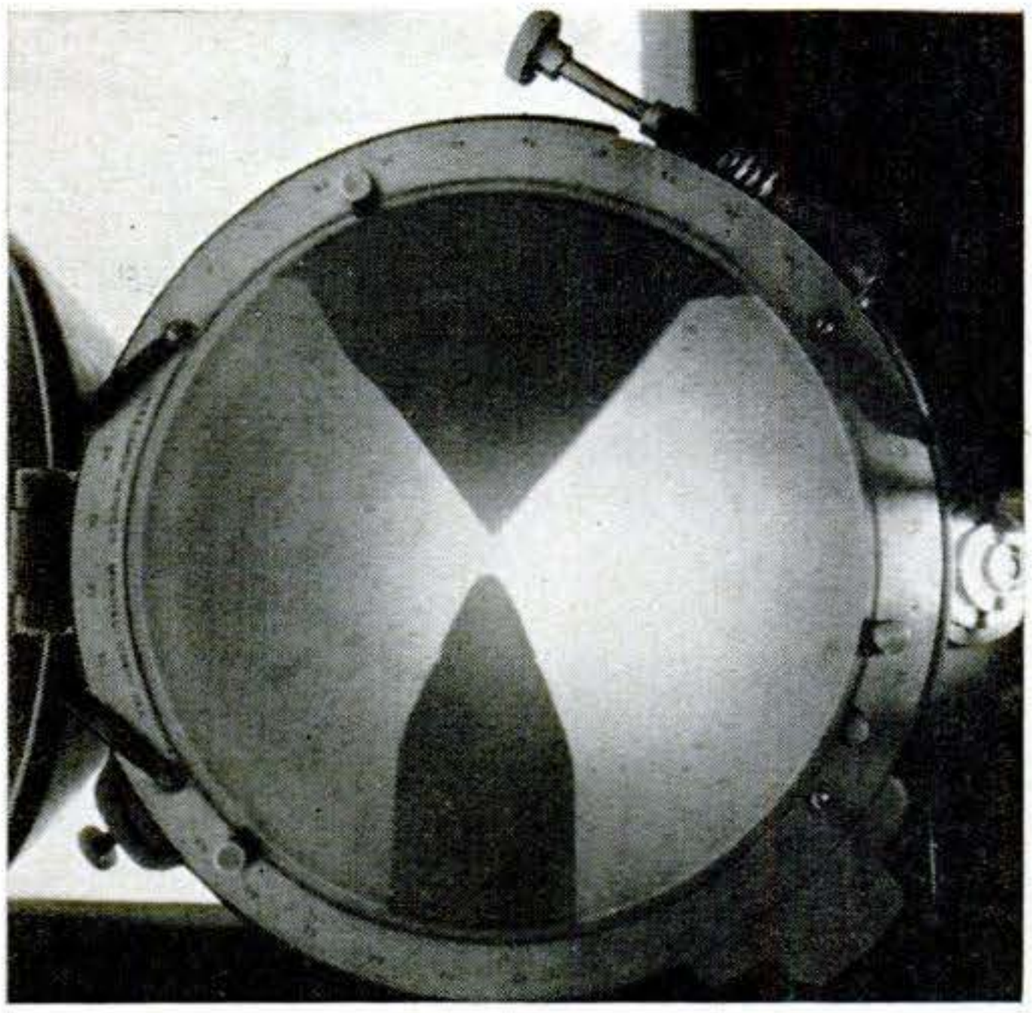
Propeller shafts to rear-wheel drives are disconnected and stored in the truck bed. Gas, brake, and electrical lines are disconnected.

Truck, now in two independent sections, is ready to be loaded aboard plane. A soldier will walk behind front section to steer dolly.



Canada Tests Jet Fighter

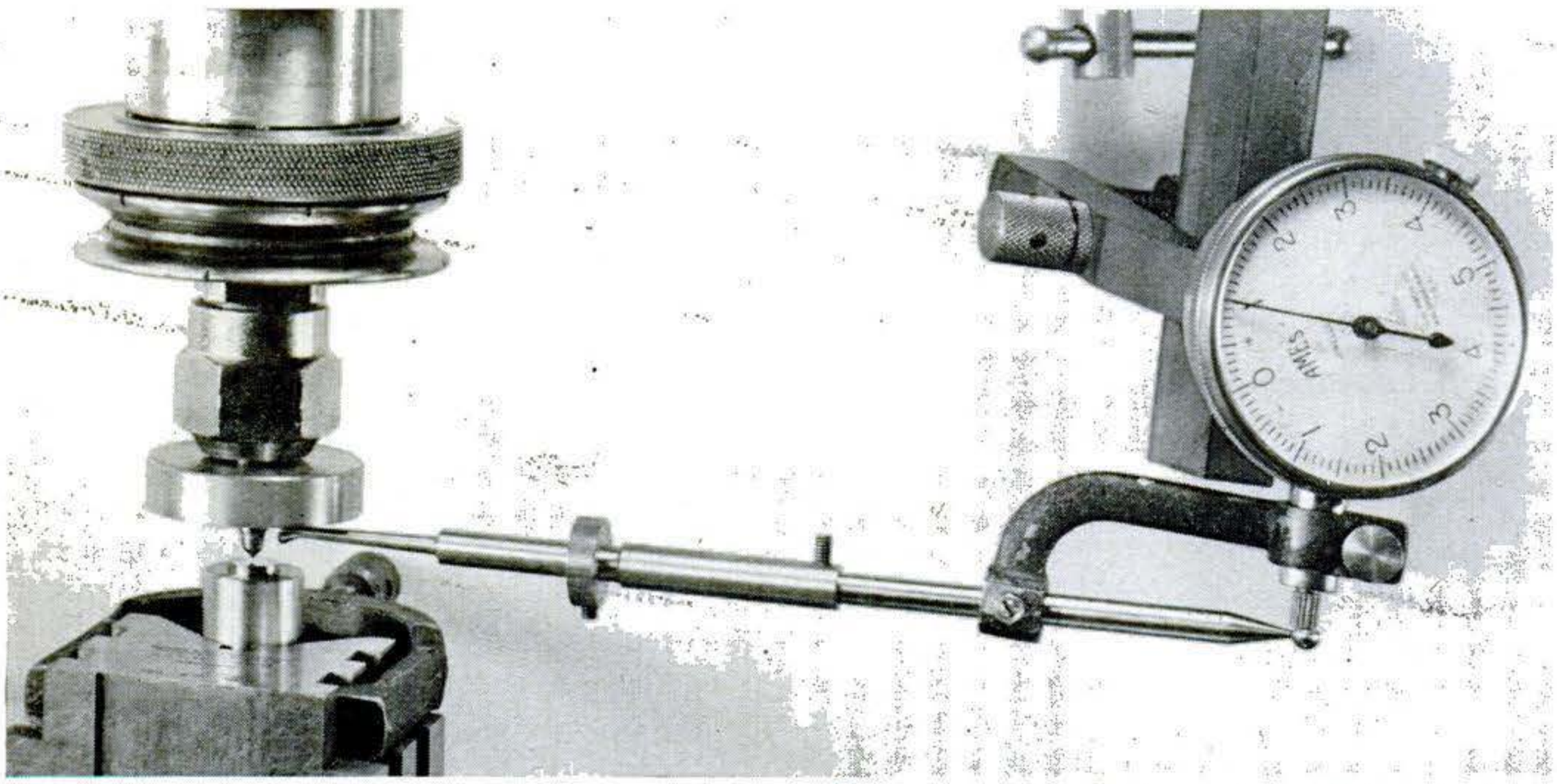
THE Avro CF-100 twin-jet, long-range, all-weather interceptor, shown above, is the first front-line jet fighter plane designed in Canada. Its two Rolls-Royce Avon engines, powering the prototype, will be replaced in later models by Canadian designed and built Avro Orenda turbojet engines. The new jet plane carries a crew of two.



Shadow photo compares points of engraving needle (top) and phonograph needle (bottom).

Sharp Needles Engrave Letters 1/2,000-in. High

SOME of the world's sharpest needles are being turned out by atomic researchers at the Argonne National Laboratory in Chicago. They are used to engrave molds for plastic dials of dosimeters, instruments that measure the radiation absorbed by lab workers. Before the molding technique was devised, the dials were engraved directly on glass, with etched lines filled with pigment to make them visible. They cost $10 apiece; the new molded plastic ones cost only three cents. The engraving points, of diamond or sapphire, are sharpened until about 1,000 times as sharp as a phonograph needle. Tested on your finger tip, they will pierce the skin before you know it.



As the supersharp needle starts engraving, lower left, depth of the needle's penetration is indicated on the dial at right. Point is sharp enough to engrave 20,000 lines per inch.

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STRIKE ZONE

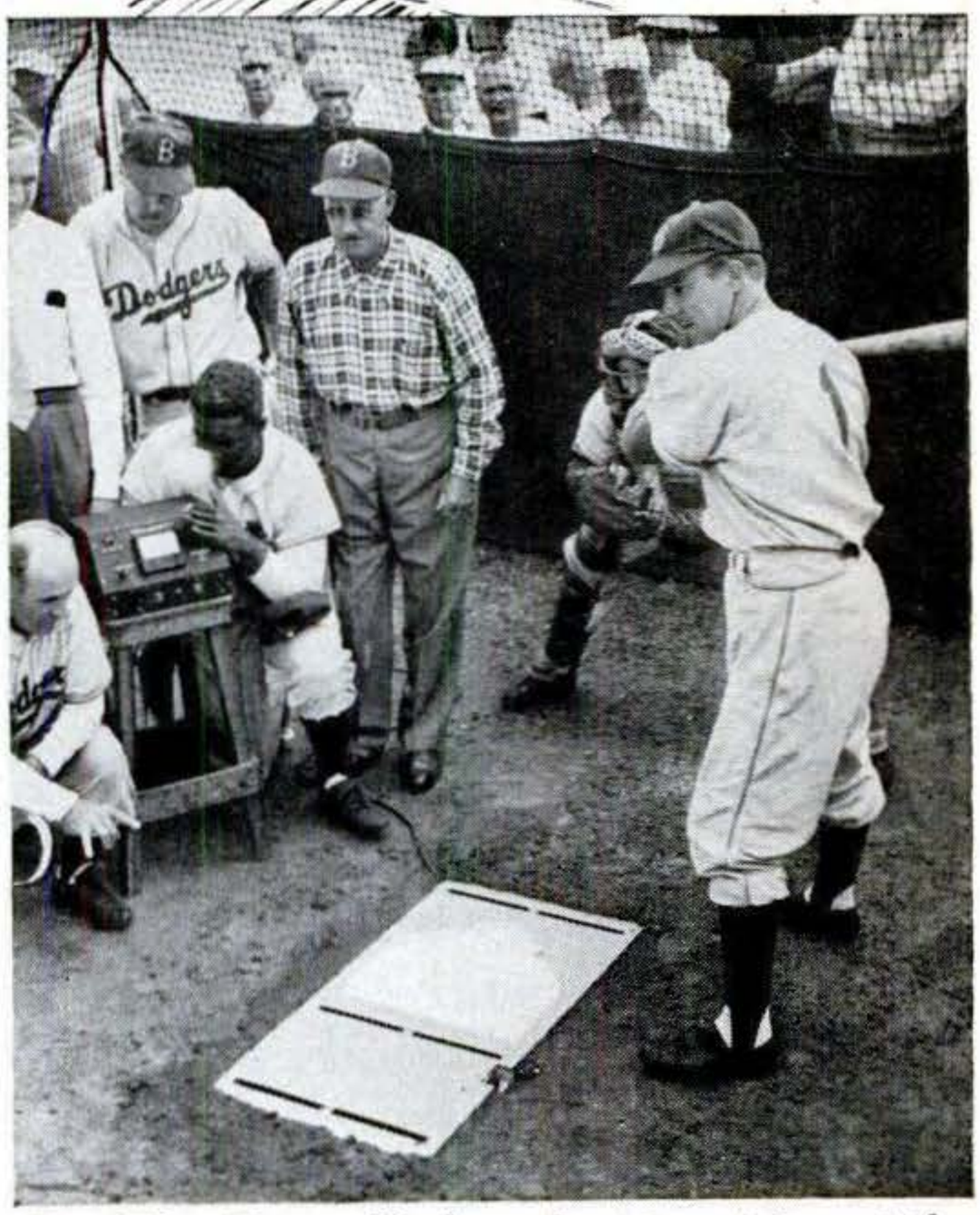
BEAM B

BEAM A

BEAM C

Electric Ump Calls Strikes

HERE'S an umpire even a Dodger can't talk back to. General Electric developed the electronic version of the man in blue for the Brooklyn spring-training camp. A metal box, about four feet long, 21 inches wide, 1½ inches deep, encases home plate. Two slots, one in front of the plate, one behind it, each exactly the plate's width, let narrow beams of light from the sky fall on photoelectric cells. These beams are broken only when the ball passes through them. To gauge balls that are too high or too low, a third beam intersects the other two diagonally. **Only a strike will break all three in the proper sequence, lighting a lamp. One catch is that it won't work at night.** END



Pee Wee Reese, Dodger shortstop, tries out the electronic arbiter. Strike zone is adjustable for batters of varying heights. Gadget is only for training, not for actual games.

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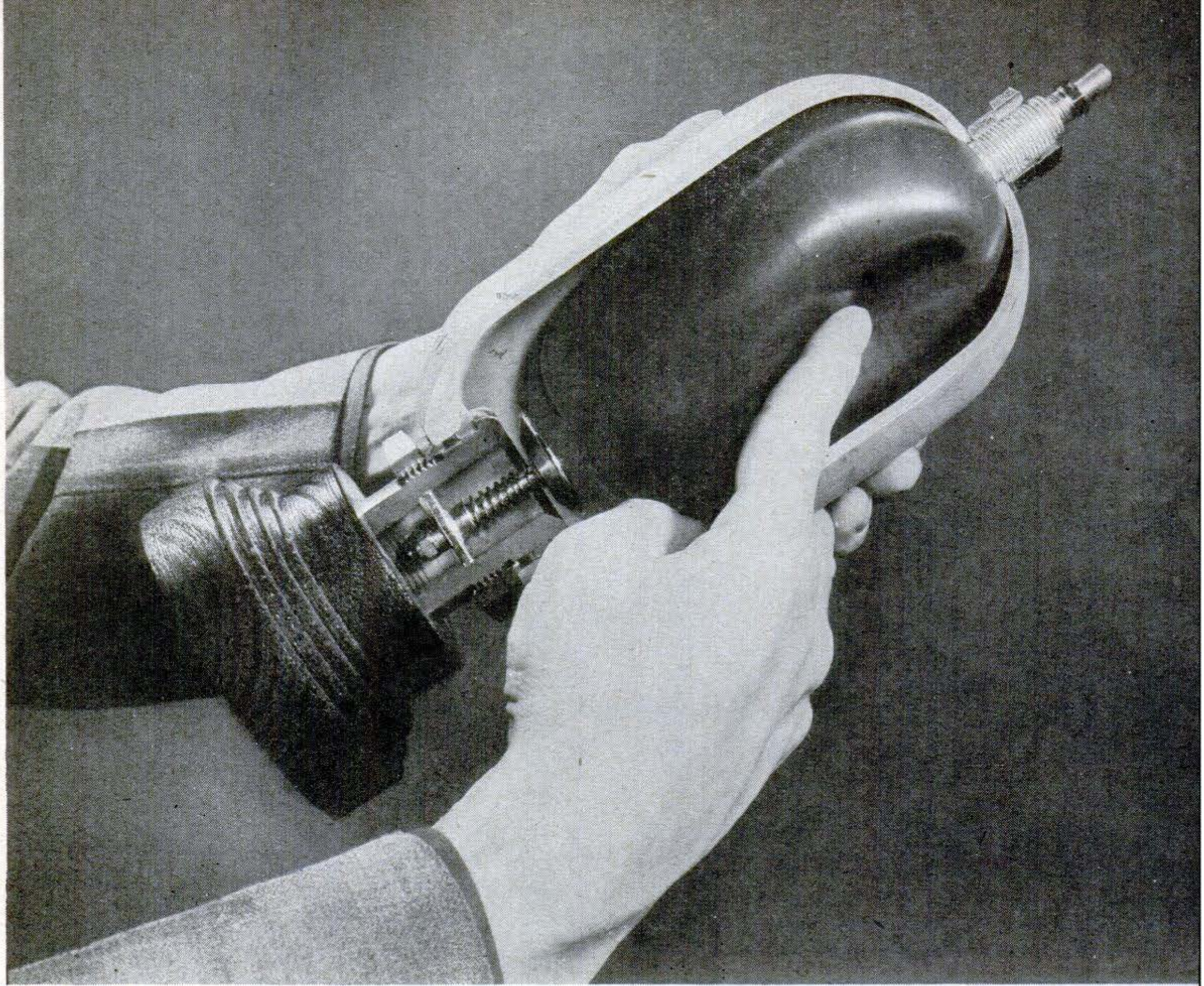

Rubber balloon in hydraulic accumulator, cut away to show construction, enables device to store mechanical energy. Inflated balloon is compressed by pumping oil into metal shell.

Canned Horsepower

Mighty midgets called hydraulic accumulators deliver stored mechanical energy to lighten heavy tasks.

By Myron Stearns

A RUBBER balloon in a steel cylinder is rapidly earning a reputation as one of the most useful modern inventions. Called a hydraulic accumulator, it is a simple but highly ingenious power package that puts the strength of Hercules at your service.

For the hydraulic accumulator stores mechanical energy as a battery stores electricity. Oil is pumped into it by a small motor. Pressure gradually builds up to a high value. When this stored energy is tapped, it will for a short time do a job far beyond the capacity, in horsepower, of the original power source.

Notice that this isn't getting something for nothing. An accumulator "saves up" the energy put out over a period of time by a small power source. It can deliver stepped-up energy only for a lesser time, and must then be replenished. But it's ideal for jobs that need lots of power in short bursts. It's also a fine emergency power source.

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Drawings show principle of accumulator, and a typical system using it, in which the accumulator stores power employed to move double-acting piston up or down in hydraulic cylinder.

New uses for the hydraulic accumulator are being found almost daily. It enables a hospital patient to raise or lower his own bed. It delivers the terrific torque needed to kick over big, high-compression Diesels for starting. It opens or closes heavy hatch covers on freighters.

During the war accumulators in planes with hydraulic landing gear let pilots land after pumps and hydraulic lines had been shot away. Accumulators in tanks made it possible for gunners to swing their turrets against the enemy long after engines running hydraulic pumps had been put out of action.

While not the first, the most modern form of the hydraulic accumulator is the "bladder" type invented in 1939 by a Frenchman, Jean Mercier. This variety has been further developed and perfected by an American engineer, Edward M. Greer, and is manufactured by a firm he heads, Greer Hydraulics, Inc., of Brooklyn, N. Y. It dusts off and applies classical, but comparatively neglected, principles of hydraulics.

An accumulator of this design consists of a cylindrical steel shell containing a rubber balloon that is inflated with air or inert nitrogen gas to a pressure of several hundred pounds to the square inch. Secret of the device's ability to store pressure is the balloon.

Like water and other liquids, oil is virtually incompressible. But the gas in the balloon can be compressed, and it is, as more and more oil is pumped into the shell. The pressure of the gas correspondingly rises. Through the flexible balloon, the increasing pressure is transmitted to the oil itself.

Stored until wanted and then released by turning a valve, the pressurized oil will drive a piston in a hydraulic cylinder to perform all sorts of useful tasks. To suit the job, accumulators come in a wide

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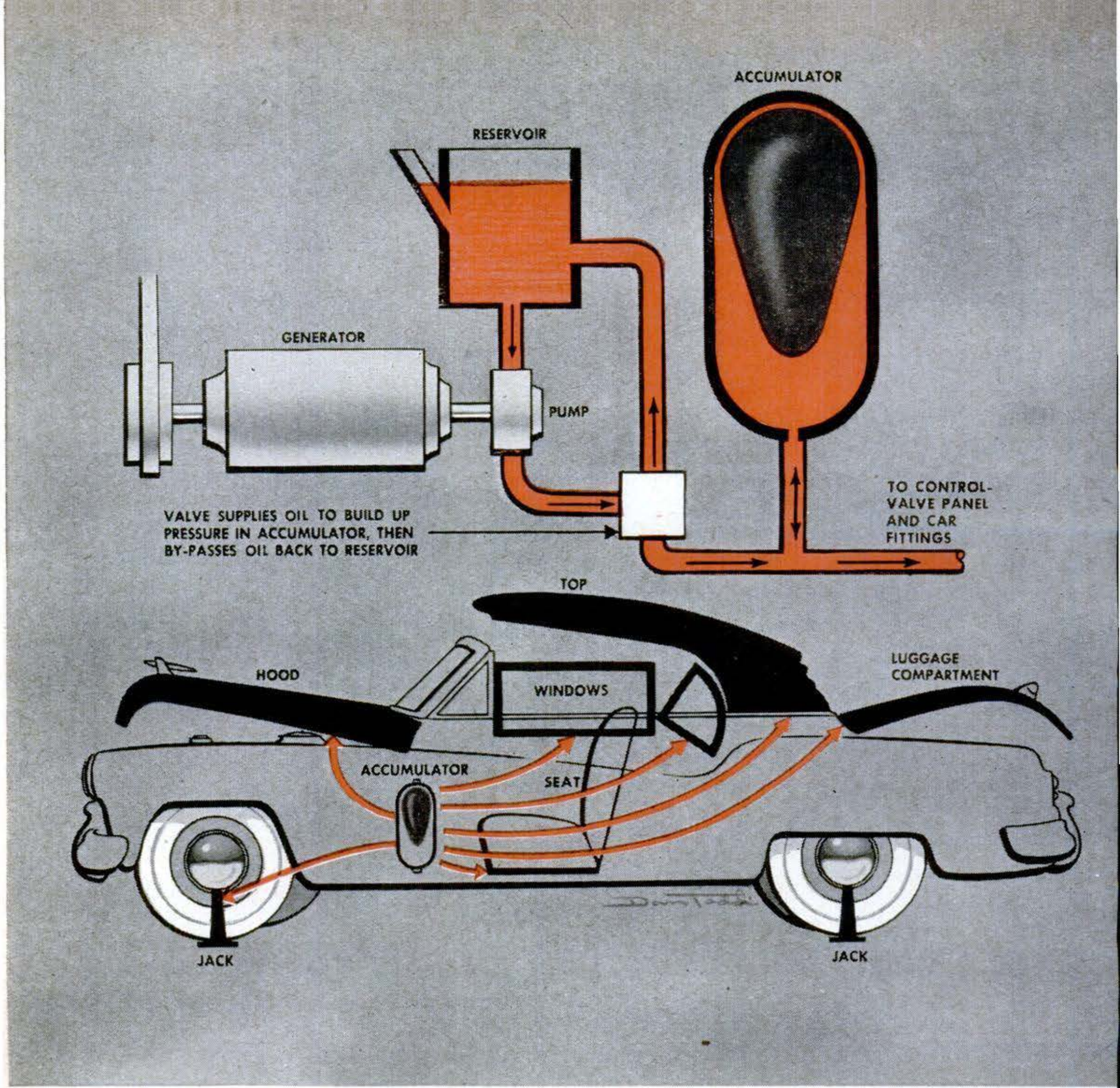

Push-button system with built-in accumulator and generator-mounted pump could adjust car's top, windows, hood, driver's seat, and luggage-compartment cover, and raise the car on jacks.

range of sizes—from babies of teacup capacity up to 10-gallon affairs. By connecting several of the latter together, installations of 40-gallon capacity have been made.

For operation of a hospital bed, a compact box beneath the spring contains a one-quart accumulator and a small electric pump that feeds it with oil from a reservoir. In only a minute or so, the pump builds up a pressure of thousands of pounds to the square inch. Then it stops. It starts again as soon as pressure falls off through use.

Within easy reach of the patient is a bedside control handle. Draw it one way, and the bedspring slowly rises, easing the patient to sitting position. It would come up just as inexorably if an elephant were lying on it. To stop it at any desired angle, the patient simply returns the control lever to "off." Moving the lever the other way levels the spring again.

A similar system in an auto, Greer says, would raise or lower top and windows, and perform other duties including jacking up the car, when the driver pressed convenient buttons. In one design he has on his drawing boards, a small pump mounted just behind the generator and driven by the same shaft feeds the accumulator. When the accumulator contains enough pressure, an automatic valve by-passes oil from the pump back to its reservoir.

Heavier jobs are made as simple. Handling cargo-vessel hatches weighing up to

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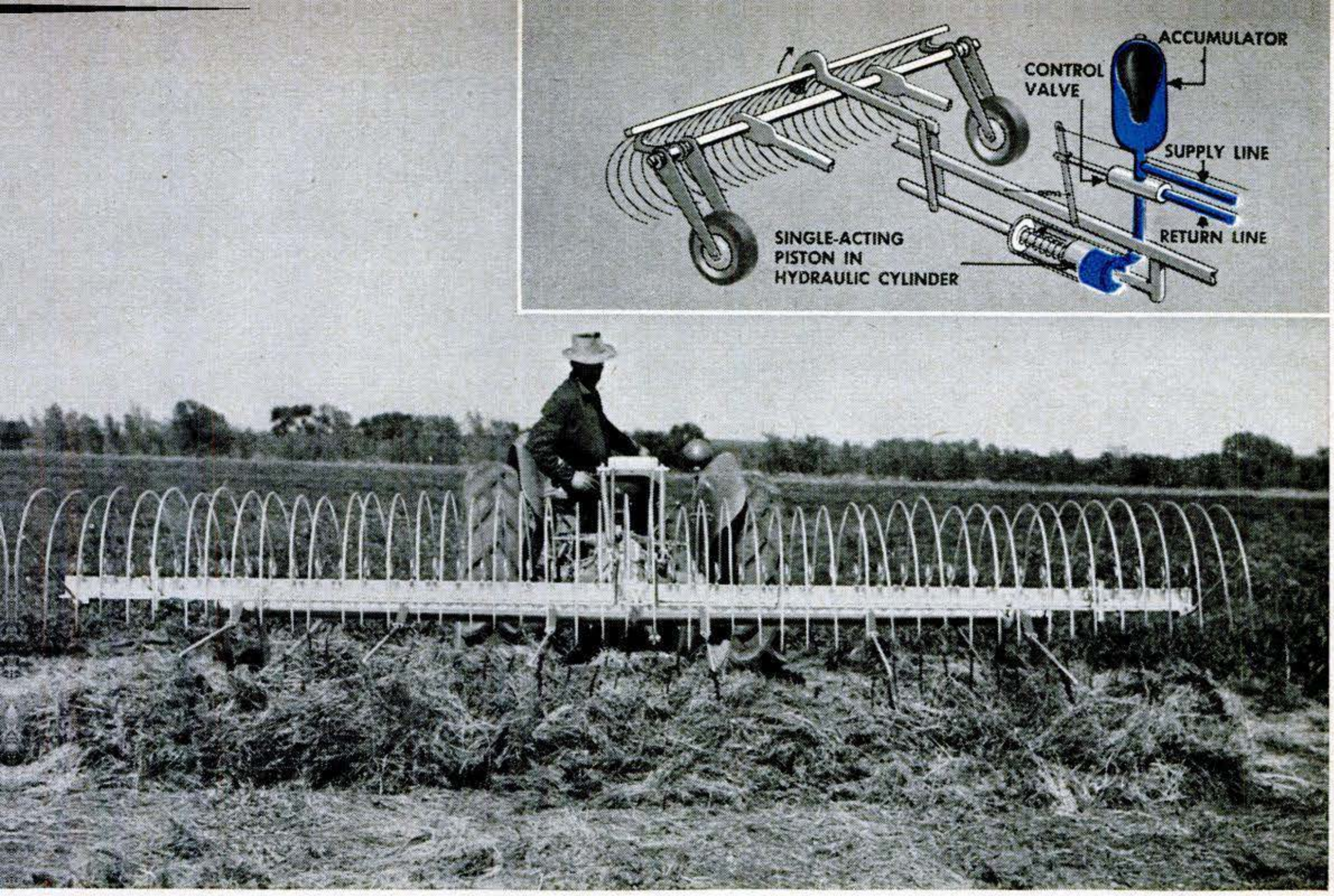


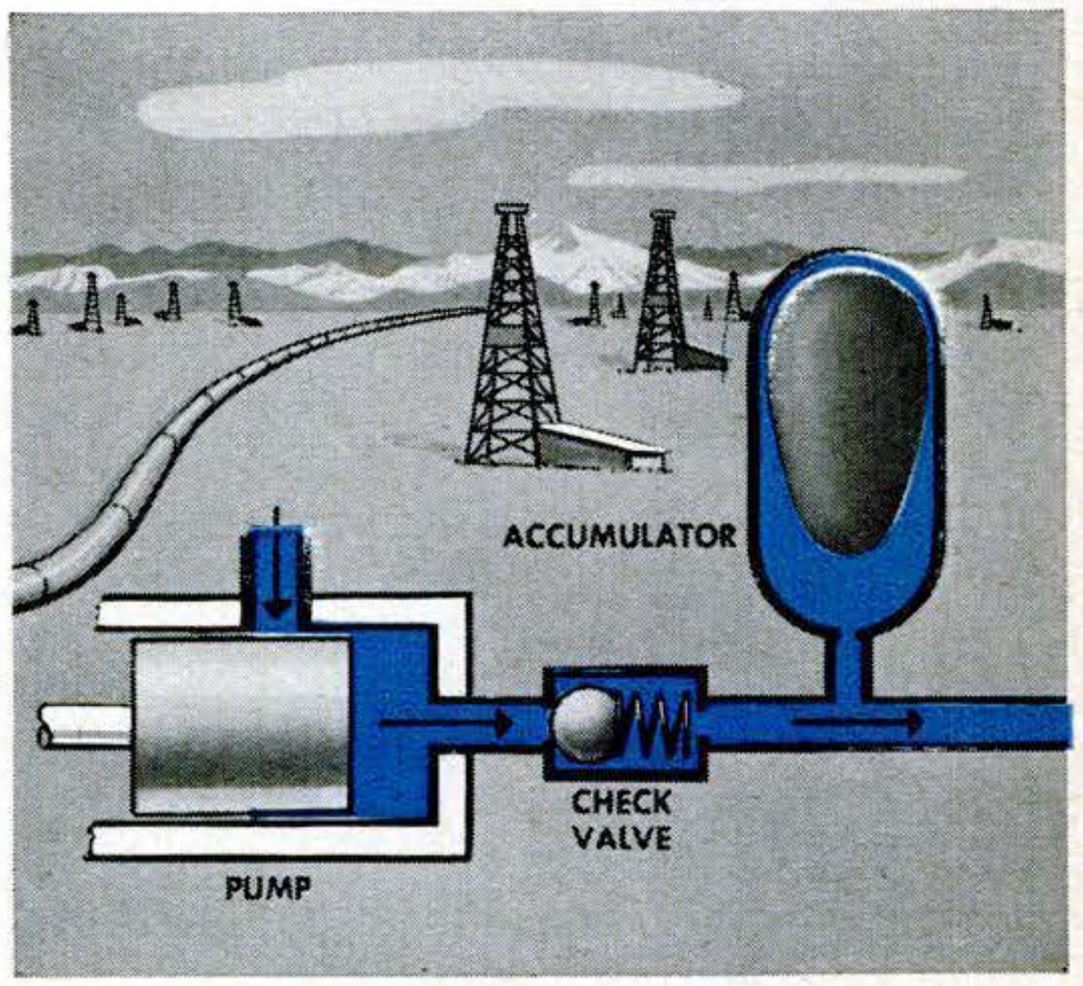
Gentle tug on control cord lifts this heavy farm rake. Accumulator providing the power (inset) is connected by pair of oil lines to hydraulic system of tractor that draws rake.

seven tons has been a slow and laborious operation. But by pushing buttons, an attendant can now open or close hatch covers of a new design, powered by built-in hydraulic accumulators, in three minutes' time.

Tractor-drawn farm rakes of 12- to 24-foot span, used for raking hay, are lifted and dumped by a hydraulic accumulator connected to the tractor's hydraulic system.

Big presses that stamp hot metal, to make gears, have a three-inch stroke requiring 50 tons' pressure for one second. Taking advantage of a 10-minute wait between pressure strokes, engineers tried fitting a press with a pair of hydraulic accumulators of 7½-gallon total capacity, to build up the pres-

Hospital bed with built-in accumulator can be adjusted by patient to suit himself, without awaiting busy nurse's help. Spring rises as shown, or lies flat, at touch of control lever.



As shock absorbers, accumulators cushion pulses of powerful pumps used to drive petroleum through cross-country pipelines, and to force drilling fluid down oil-well shaft.

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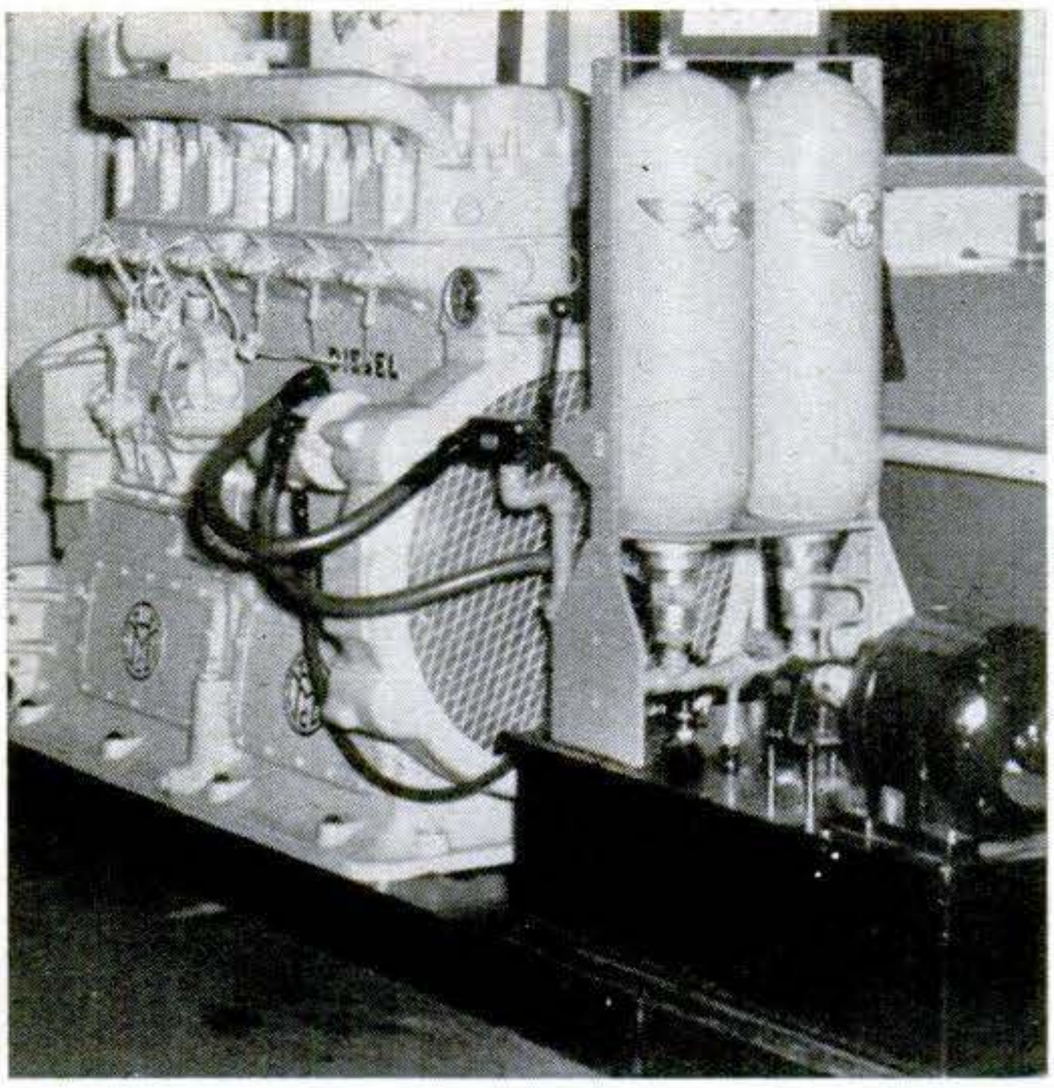
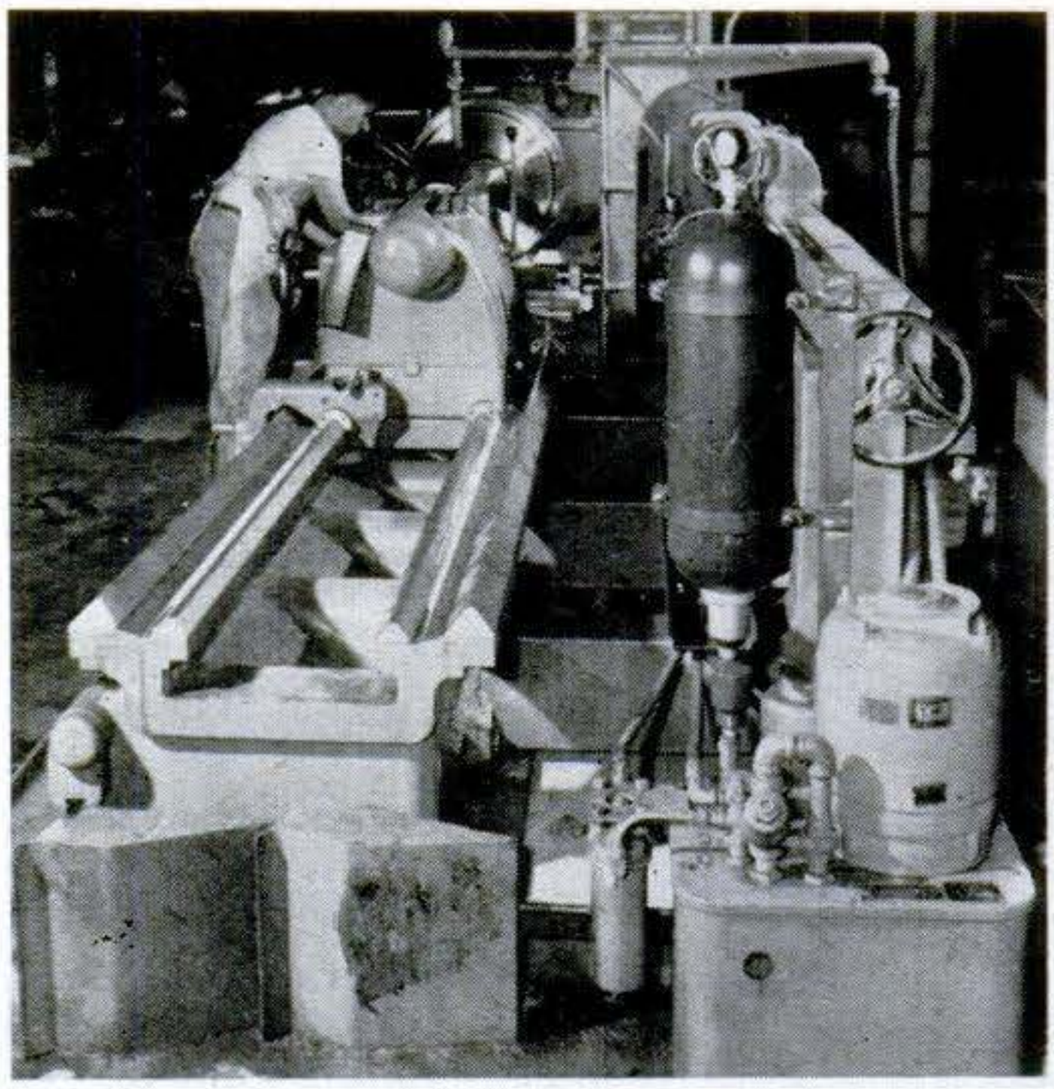


Diesel-engine starter of new nonelectric design uses pressurized oil from accumulators, at upper right, to turn small multicylinder hydraulic starting motor attached to engine.



Accumulator furnishes power for a follower on a template in hydraulic duplicating attachment of this lathe, shown making shafts for GE jet engines in Ranger plant at Farmingdale, N. Y.

sure meanwhile. Now a 1½-hp. motor, which pumps oil to the accumulators, replaces the 50-hp. motor that formerly ran the press.

Industrial installations are the most numerous to date. In typical ones, accumulators install valve inserts in Ford engines, press phonograph records, operate welding machines, and actuate hydraulic duplicating attachments of lathes.

As a power source, a hydraulic accumulator usually drives a single- or double-acting piston in a simple hydraulic cylinder. When rotary instead of reciprocating motion is wanted for turning a shaft, an accumulator can be harnessed to a compact multicylinder hydraulic motor. A Diesel-engine starter of this type, powered by hydraulic accumulators, is in current use.

Snubbing Bumps Another Job

Accumulators serve as shock absorbers, too. They smooth out the pulses of pumps that force oil through pipelines, and do a similar job for the rigs that circulate "drilling mud" down oil wells that are being sunk. They eliminate "water hammer" in plumbing systems. Massive rollers of steel and sugar mills "give," in bearings acting against accumulators, to avoid damage when foreign objects get between them. Unbreakable rocks pass harmlessly through rock crushers similarly protected.

The accumulators will handle any fluid harmless to their rubber—not only oil, but also water, orange juice, milk, beer, and blood plasma, among others. In one use, they supply high-pressure water for testing the strength of tanks.

In early hydraulic accumulators, pressure raised a piston against weights or springs, but leakage past the piston was always troublesome. More effective designs followed the pattern of the air dome used in reciprocating pumps and hydraulic rams. To prevent mixing of the air or gas with the oil, a diaphragm type with a spherical chamber was developed. A flat sheet of rubber stretched across its middle separated oil pumped in, on one side, from air trapped on the other. Its operation depended on the ability of the comparatively fragile rubber sheet to withstand strains along its edge.

Use of a balloon for a pneumatic chamber distinguishes the Mercier-Greer bladder type from all of these. Anchored to the shell at only one point, the balloon floats practically freely in the surrounding oil.

So simply and effectively that it amounts to a stroke of genius, this balances every force acting on the rubber wall. By the fundamental laws of fluids, pressure on the balloon will be equal everywhere—inside and out, and in all directions. Hence there can be no strain on the balloon, no matter how terrific the pressure. In the test of service, the balloon of one accumulator was found apparently as good as ever after more than two and a half million flexings. END

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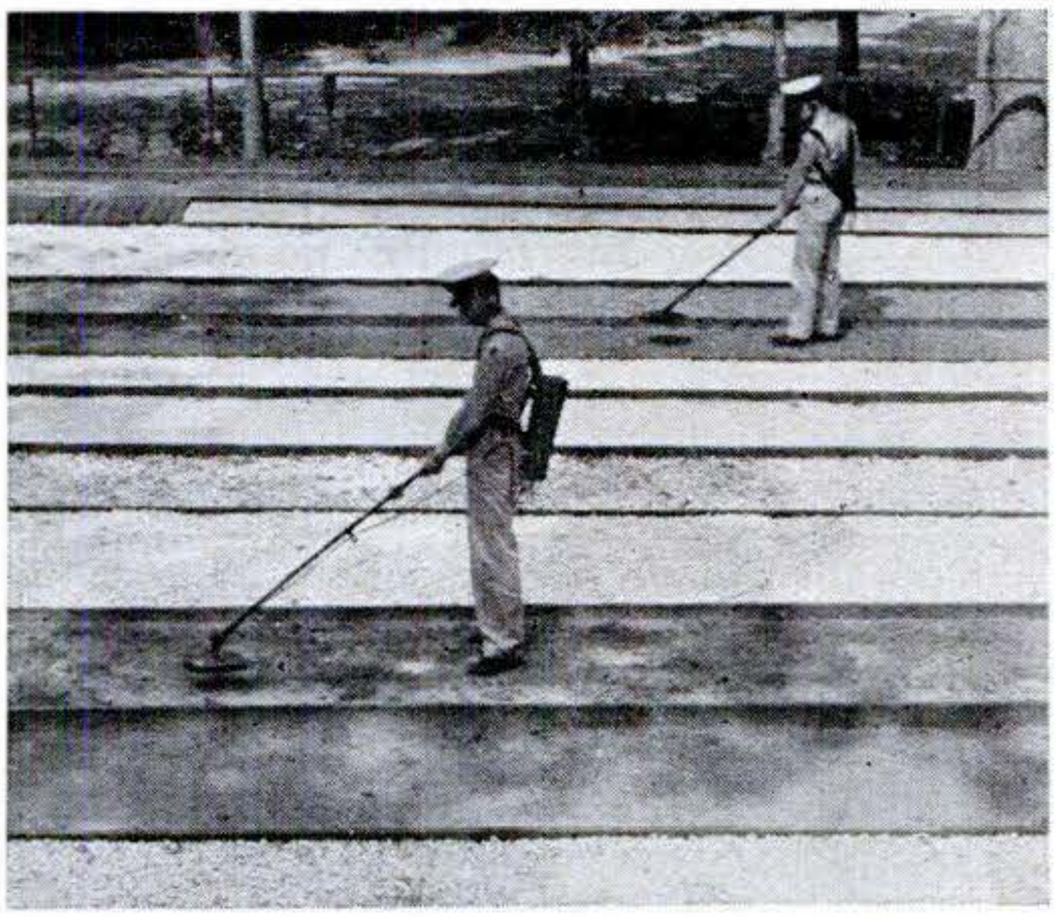
Hot Torch Has "Cold" Flame

A TORCH so hot it melts tungsten or quartz (left)—yet has a "cold" flame—has been invented by Dr. J. D. Cobine, of the General Electric research laboratory. It uses a magnetron tube to generate radar-frequency waves, which make the molecules in a nitrogen-gas jet break up into atoms. When the nitrogen atoms hit a surface, they join up into molecules again, liberating a great deal of heat. However, the heat exists only at the surface of the work, so the flame itself is not hot in the ordinary sense. No commercial use has been found for the torch. Its flame results from electronic motion caused by the radar waves, which have the high frequency of one billion cycles per second.

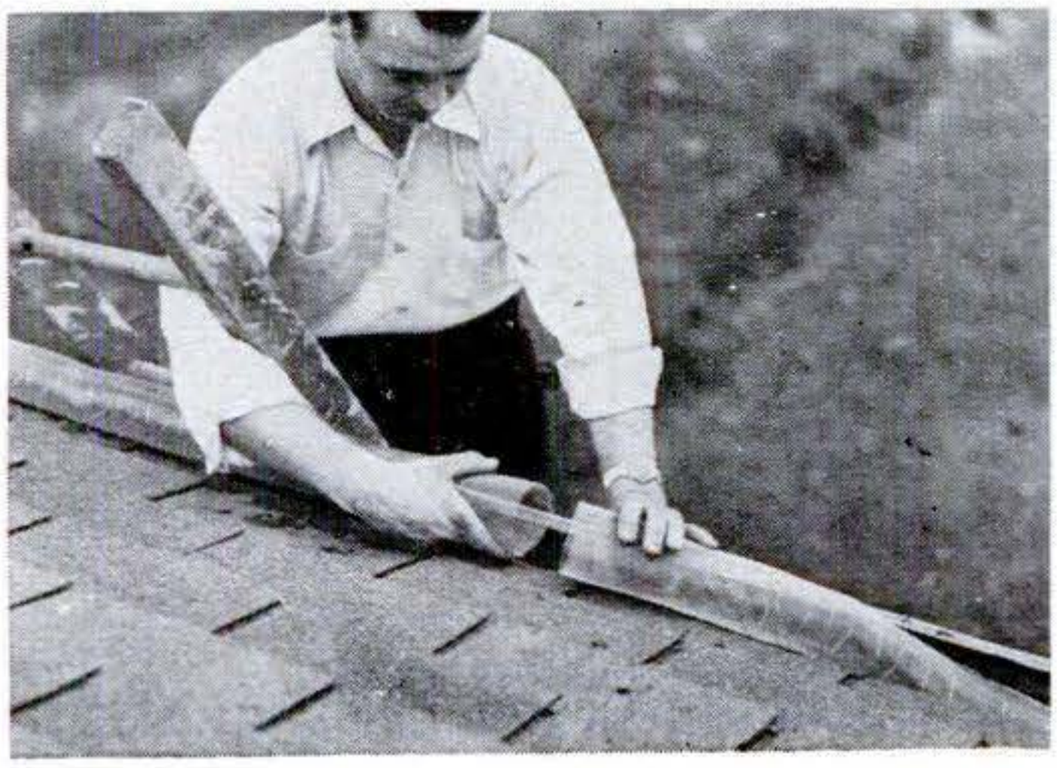


Soils Test Mine Detectors

IN THE hope of developing mine detectors that will work in all soils—present models do not react reliably over ground containing iron ore—the Army has set up this testing area, at Fort Belvoir, Va. It is made up of narrow, parallel strips of dirt representing soils found all over the earth. Mines and metal disks are buried in the testing lanes.

Scoop Retrieves Golf Balls

CALLED the Water Mashie®, the telescoping stick above will help retrieve golf balls driven into a water hazard. Made of aluminum, it can be carried in your golf bag, then extended to six feet, and has a net on the end for scooping up the ball. Norton Products Co., of Fort Worth, Tex., makes the stick, which is priced at $2.50.



Tube Protects Roof Gutter

DRAINPIPES stay free of clogging leaves when roof gutters are lined with the tubular bronze screening at left. Reinforced with a brass spring, the tubing is flexible, permitting it to be laid around corners. It comes in five-foot lengths that fit into one another to form a continuous tube. Wynnco Products Corp., of Atlanta, Ga., is the maker.

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Striking evidence that the new type of asphalt-stabilized adobe brick is really waterproof is furnished by this small building. It withstood a flood that rose to height indicated by man's hand. The bricks weren't even eroded.

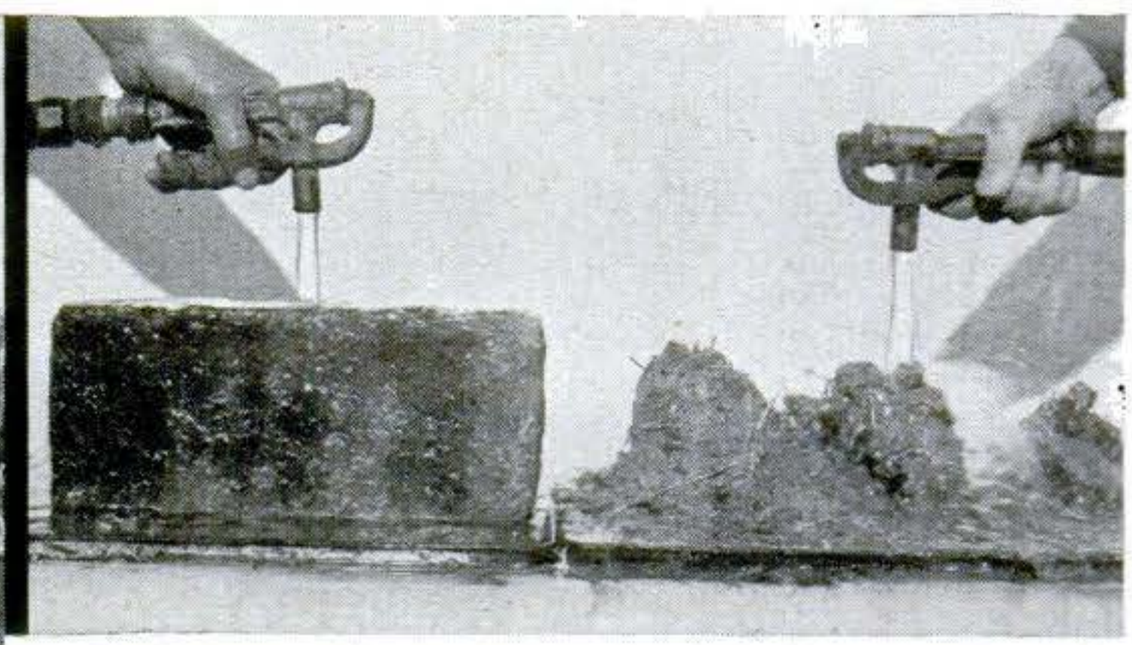
New Mud Bricks Are Waterproof

ADOBE—sun-dried mud—is a fine building material, so long as it doesn't rain. Too much water can turn it back into mud. But now adobe can be made waterproof.

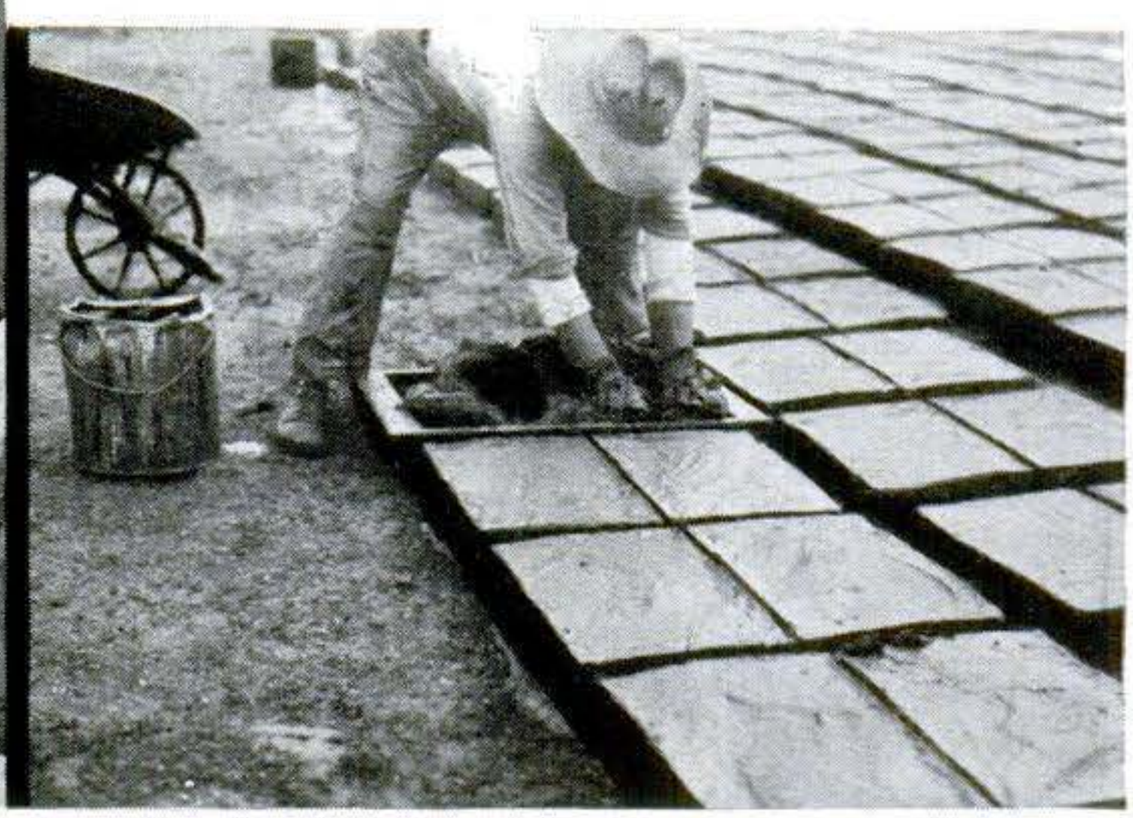
The secret is Bitudobe®, a sticky chemical technically termed an emulsified asphalt stabilizer. Mixed with the right kind of clay soil and water, it binds the soil particles together. They dry into strong, waterproof bricks after being cured in the sun.

Biggest advantage of adobe is its cheapness. Frequently the bricks can be made right at the construction site from the dirt that is there. The finished product is an excellent sound and heat insulator, and can be painted or plastered. It won't burn, and resists insects. The stabilizer is made by American Bitumuls Co., San Francisco.

A workman adds Bitudobe stabilizer to soil-and-water adobe mixture. For small jobs, the mud is prepared in an ordinary paddle mixer of the type used for making cement. Pugmill and continuous mixers handle larger quantities.



Ordinary adobe brick (right, above) is quickly disintegrated by a stream of water. Yet brick that has been stabilized is not affected. While fairly strong, bricks can be cut with hatchet.



Sticky adobe mixture is poured into wooden forms and packed into the corners by hand. Next the bricks are allowed to cure in the sun for 20 to 25 days. That's all there is to manufacture —the sun-hardened bricks are ready for use.

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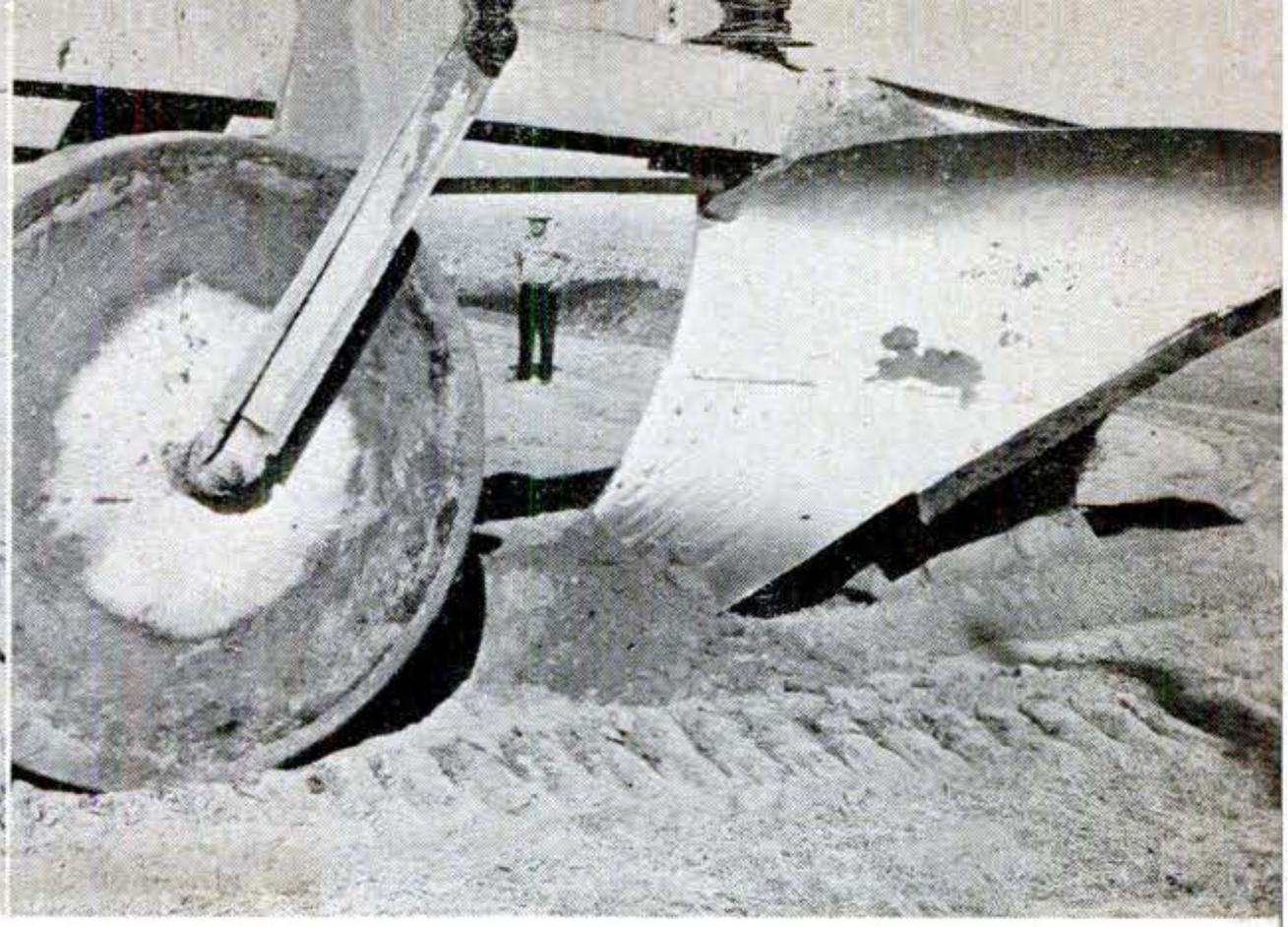

Big Plow Digs Deep Furrows

FURROWS six feet deep are all in the day's work for this plow. Said to be the world's largest, it can turn up an acre of them in an hour. It takes the combined 500 horsepower of four Diesel tractors to pull the 10-ton mammoth, shown at left above being used on a western farm to bring up rich soil buried under silt and sand deposited by flood waters. Man in background, above, gives an idea of the size of the plowshare. Hydraulically powered, it is easily raised and lowered by a tractor operator.

Plastic Cap Corks Bottle

USED for recapping partly used bottles of carbonated beverages, this flexible-plastic top won't blow off under pressure. To remove it, you push up on a tab, as demonstrated at right. Towns Quality Products, Inc., of East Orange, N. J., makes the caps.

Boat Folds Into Back Pack

DESIGNED for fishermen whose favorite haunts are out-of-the-way ponds or streams, this coracle-like folding boat can be carried on your back or bundled into a car. The 26-lb. boat measures 6 by 4 feet when unfolded, and will not tip easily in the water. Made of aluminum tubing and Vinylite-treated duck cloth, the boat comes with a folding seat. The Porta Co., of Hopkinton, Mass., manufacturers the Packet®.

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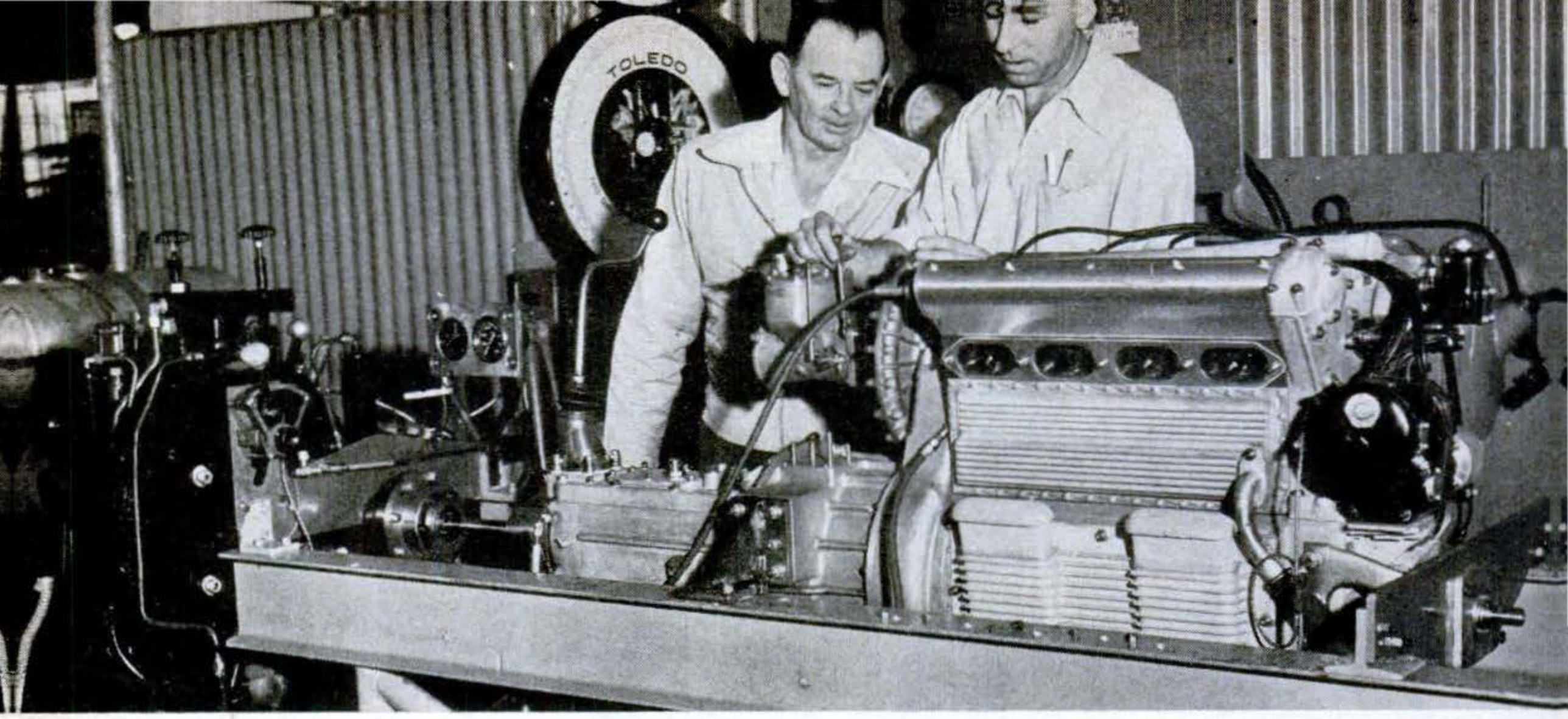
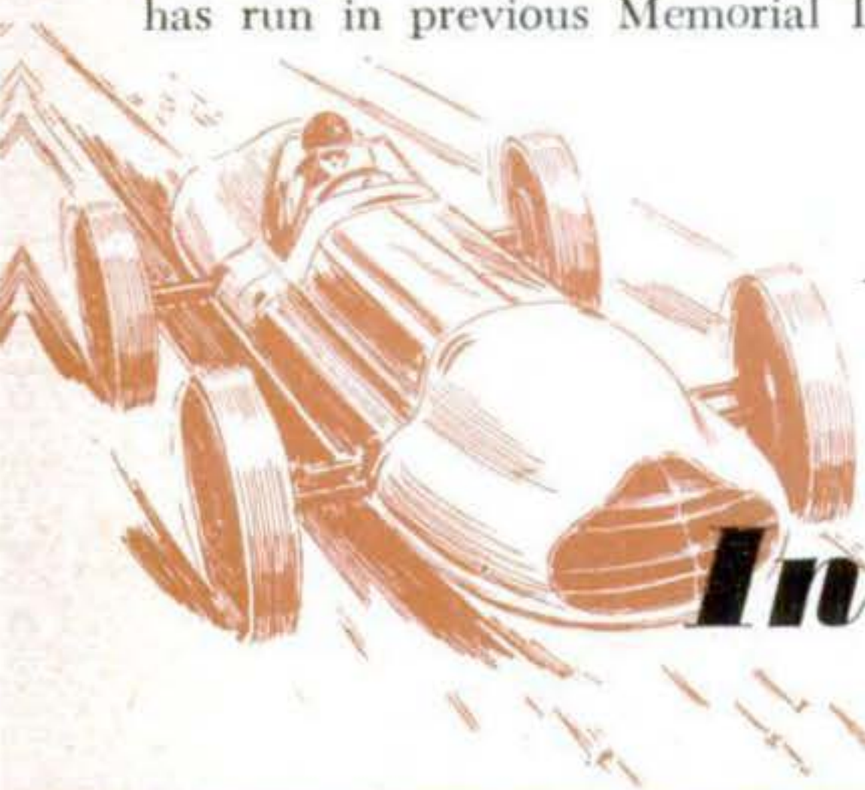
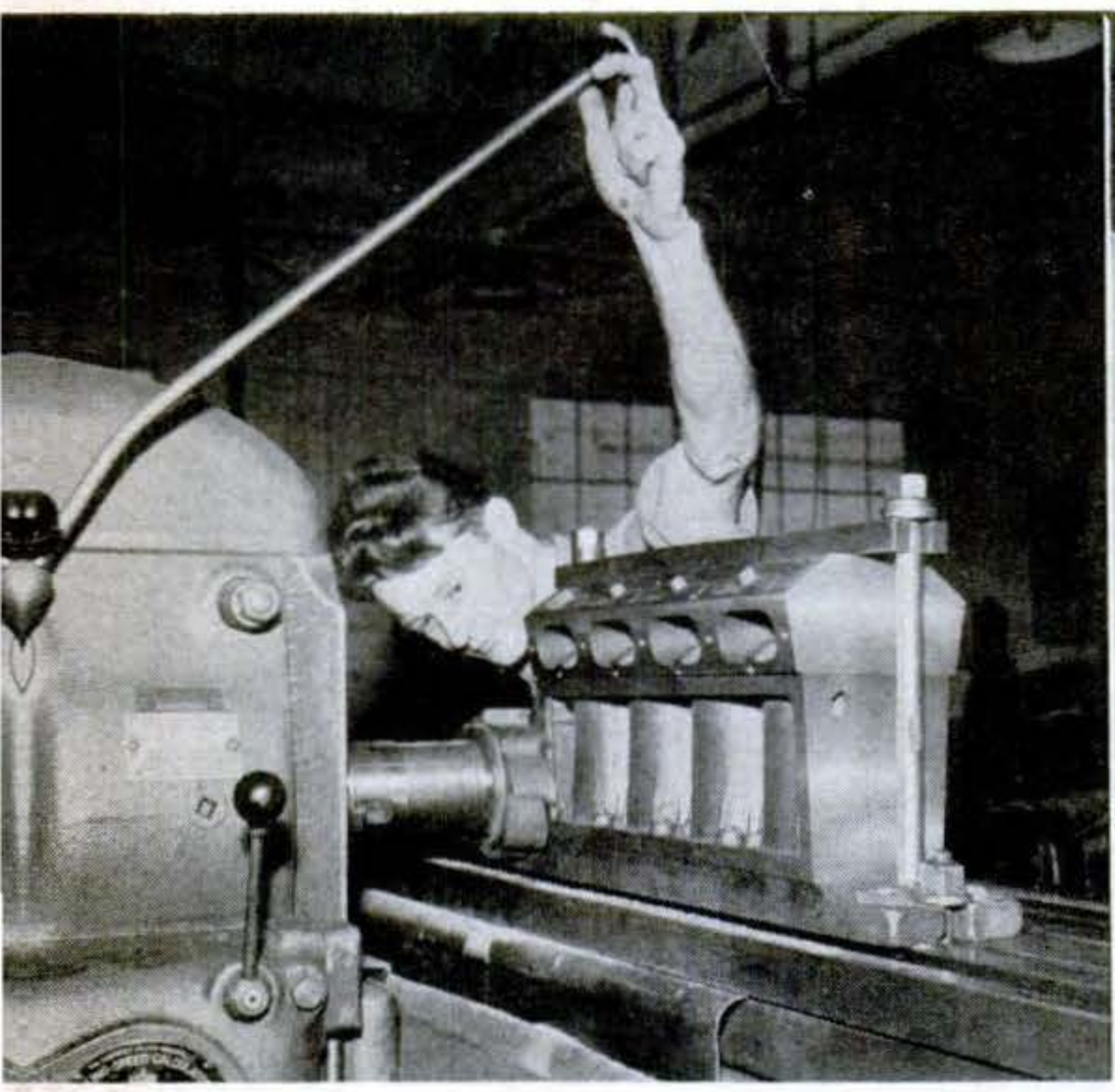


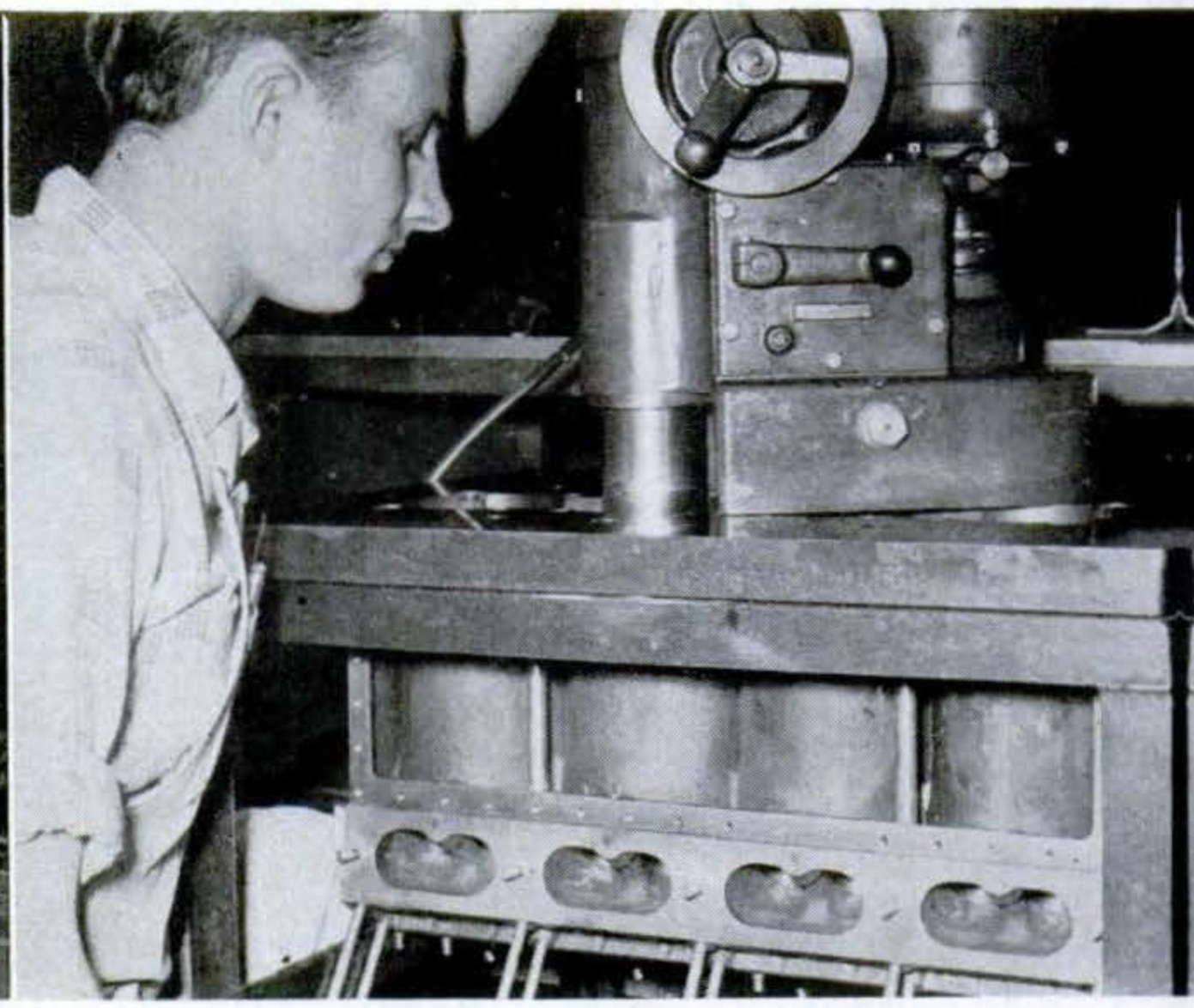
On dynamometer test, the four-cyl. supercharged engine develops 425 hp. at 6,000 r.p.m. Basically, it is the 220-cu.-in. Offenhauser that has run in previous Memorial Day races, but the piston displacement has been reduced to 176 cu. in. and a supercharger added. During the winter and spring, Meyer's firm has been at work on four engines of the 176 type.



Lou Meyer Builds New Engine for Indianapolis "500"



Machining the cylinder block requires a dozen steps. Here, milling machine faces off side, making it ready for attachment of the water jacket. Completed block weighs 80 pounds.



Block is precision-bored twice to achieve the truest possible cylinders. In the operation above, a vertical boring machine hones the cylinder walls to a smooth, glass-slick finish.

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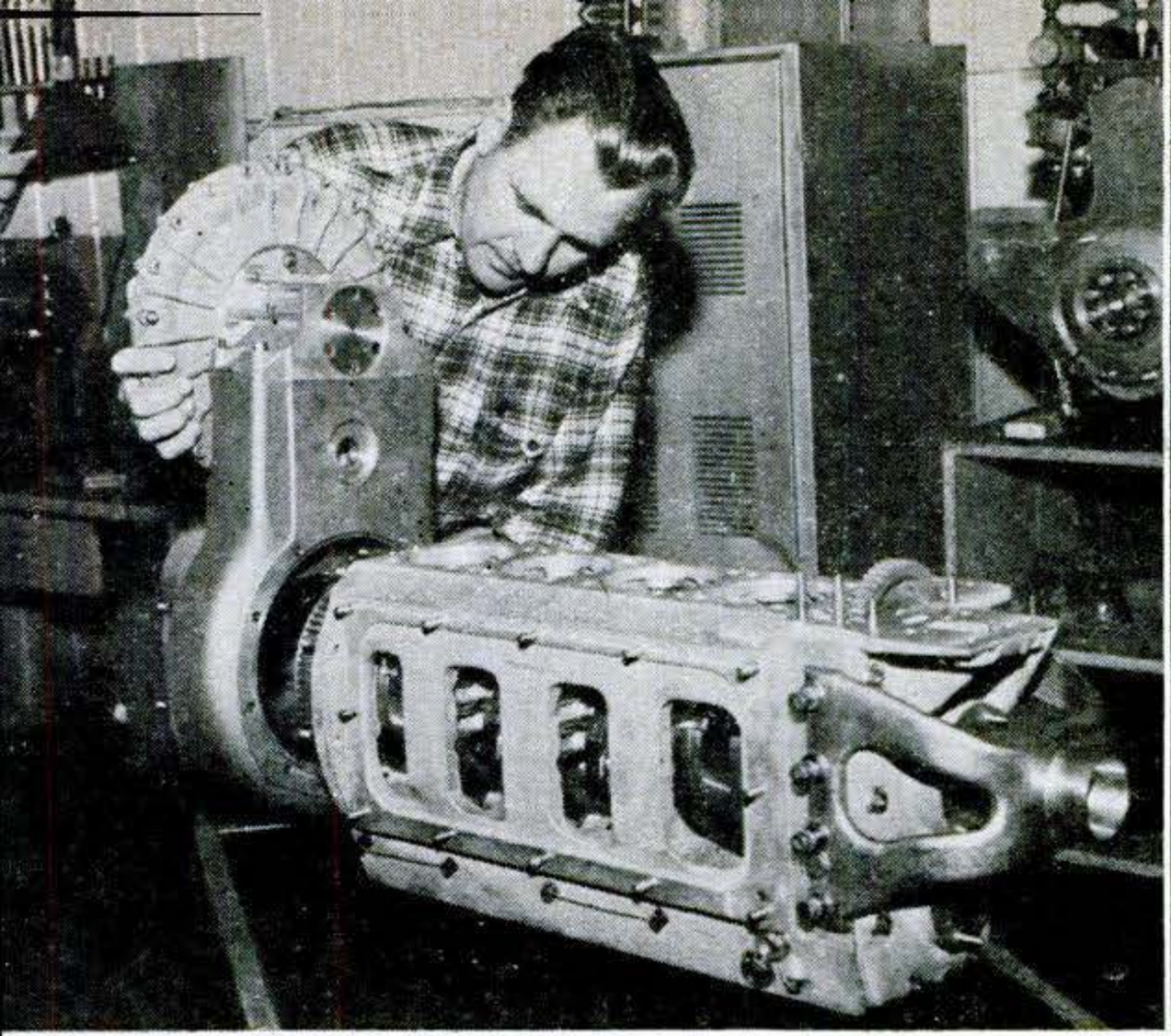


Lou Meyer shows how centrifugal-supercharger assembly fits on the crankcase. One of the two timing gears can be seen on top of the case. Object on near end is engine support.

Leo Goosens, the engine designer, holds the 24-blade impeller for the supercharger. Made of magnesium, impeller weighs 27 oz. and spins at 5⅓ times engine speed, or 32,000 r.p.m.

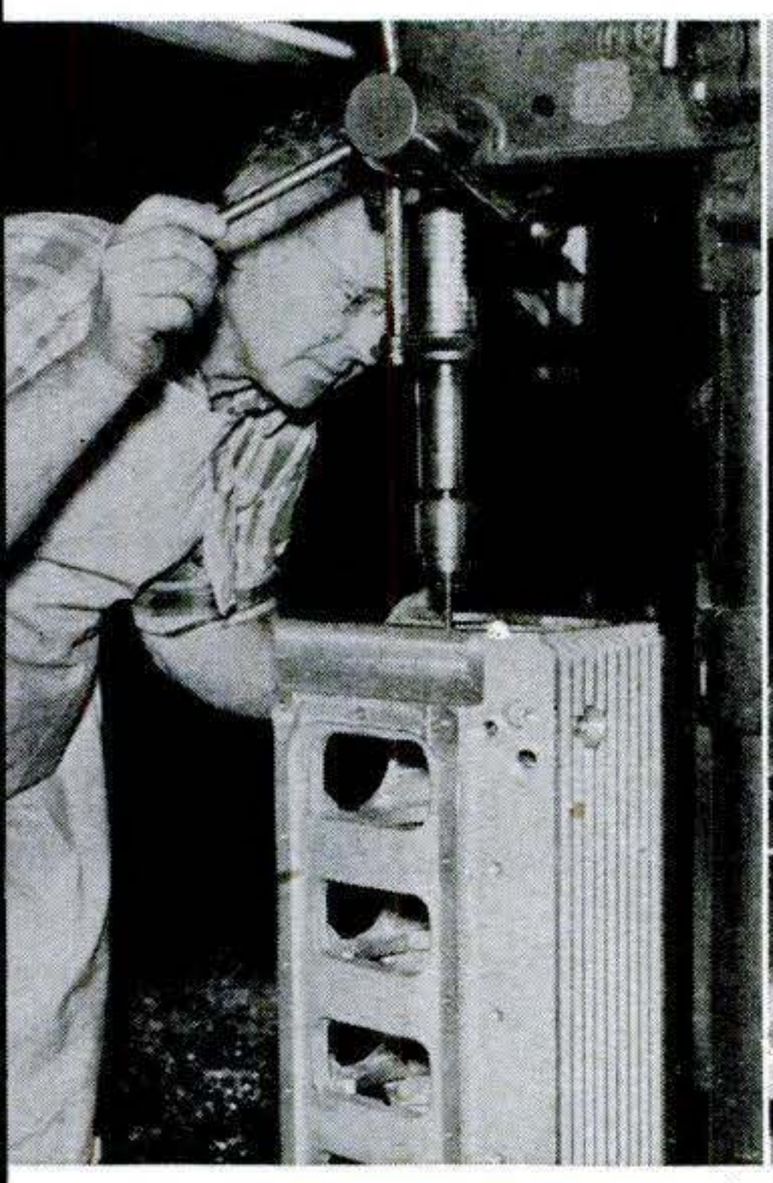
TAKE a good look at the engine being put together on these pages. Come Memorial Day, it may win the 500-mile race at Indianapolis.

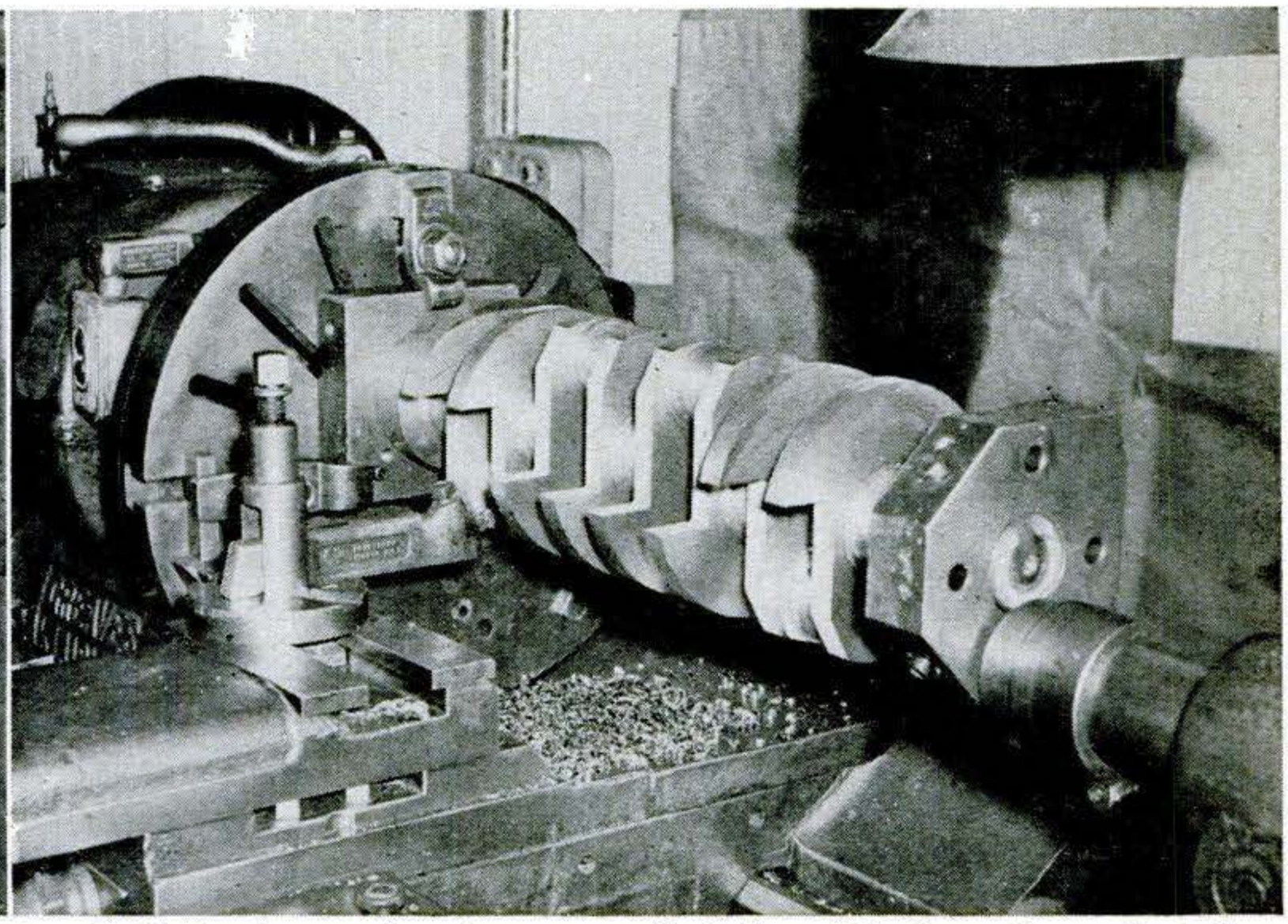
If it does, the engine will be another feather in the cap of Lou Meyer, first three-time winner of the big race. His firm, Meyer and Drake, of Los Angeles, designed and built the engine.

Based on a 220-cu.-in. engine that has run in previous races, this one has a displacement of 176 cu. in., the bore being 3.875 in. and the stroke 3.740 in. It has a supercharger with an impeller 8¾ in. in diameter.

Complete, the engine weighs about 550 pounds. Turning at 6,000 r.p.m., it is expected to give a top speed somewhere around 160-170 m.p.h.

Meyer and Drake have built four of the engines at $6,000 each. Walt Ader, Duane Carter, Johnnie Parsons, and Henry Banks will probably be the drivers. END





Aluminum crankcase, left, is drilled and tapped for front cover. It is a barrel type cast in one piece, unlike split type of passenger cars. At right, crankshaft is being machined on the lathe from a single billet of high-grade steel. When finished it will be 25½ in. long and 7 in. in diameter, will weigh 67 lb. Note fitting on near end for offset turning.

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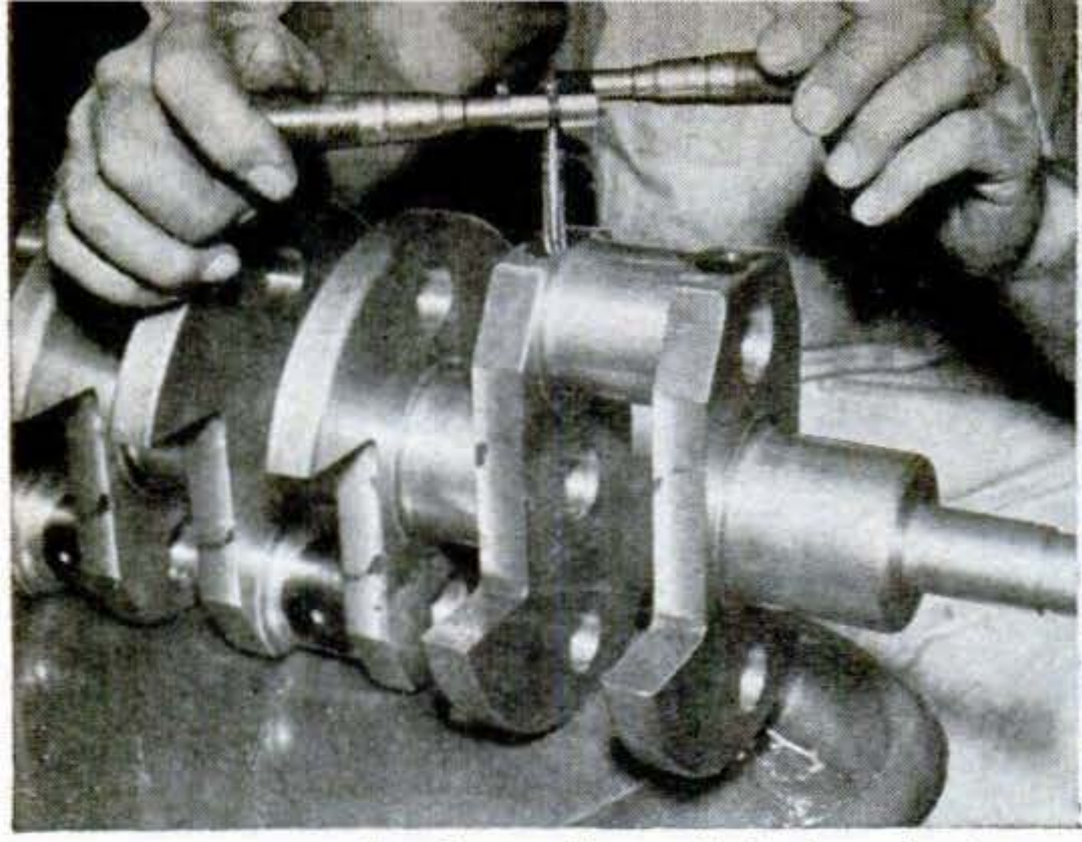
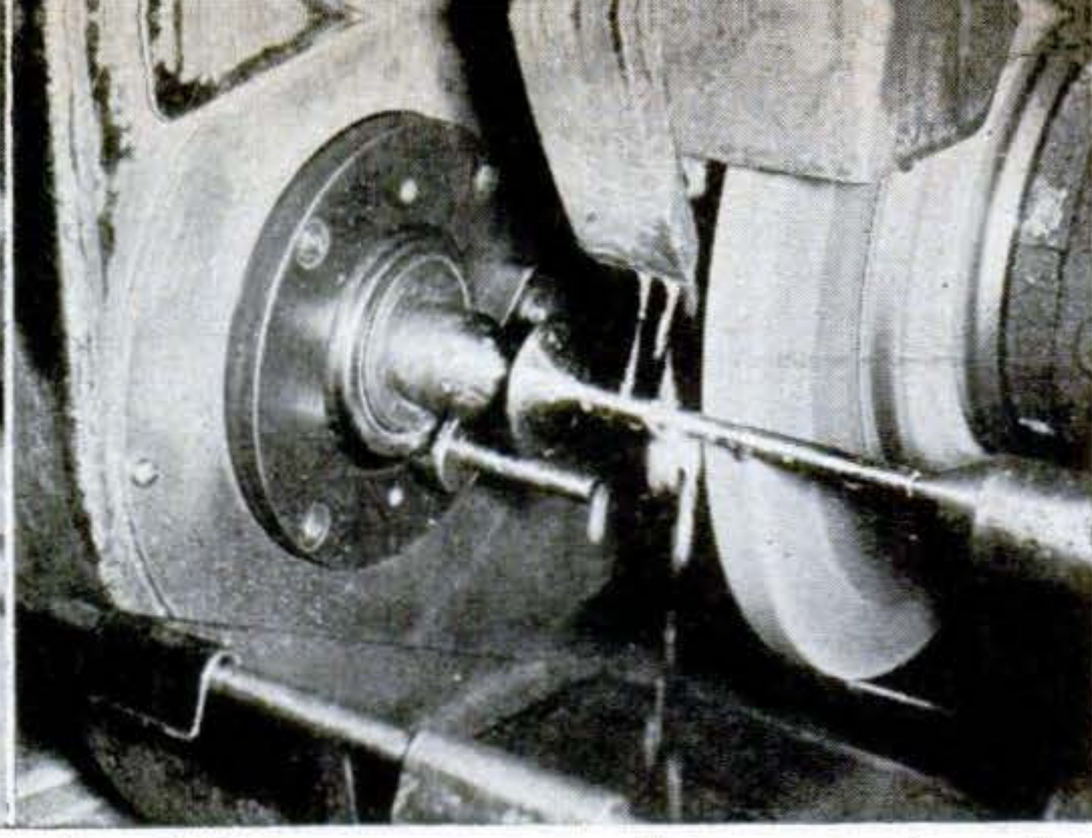
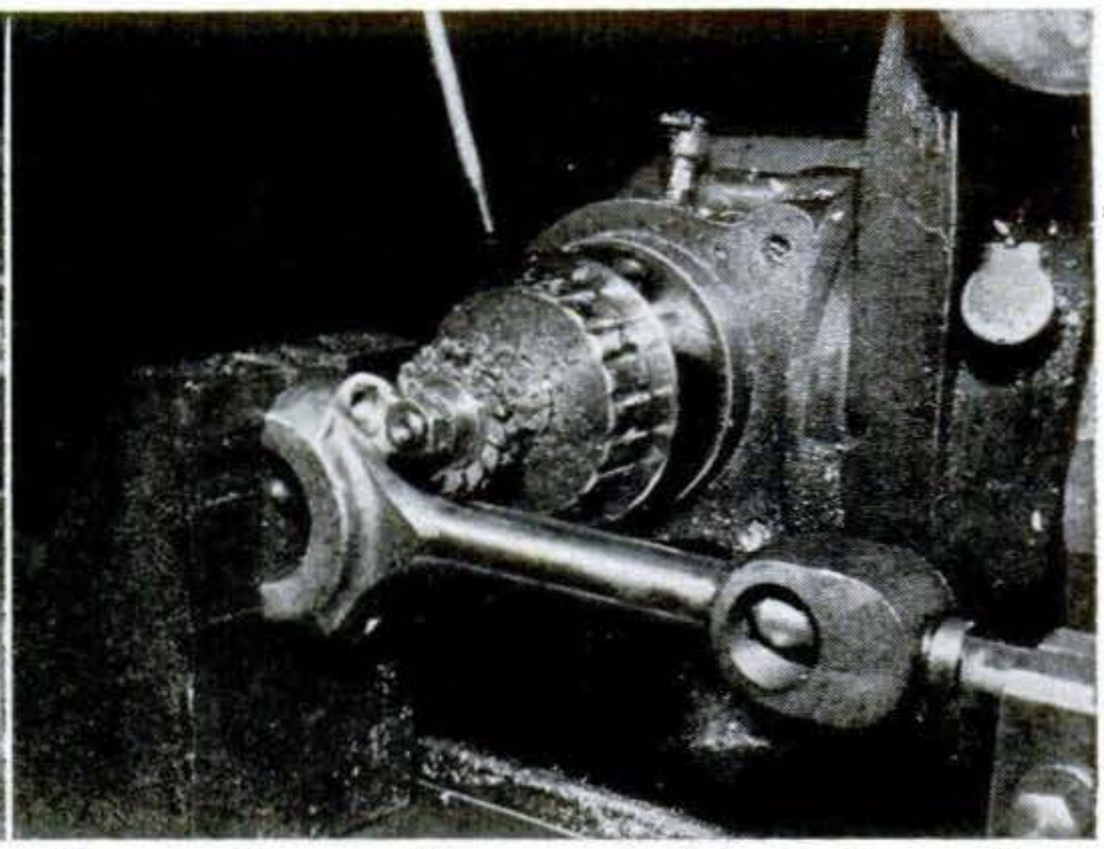


Hand tapping finishes off crankshaft, which is electronically balanced and magnetically tested for hidden flaws. Work is done only by machinists of long racing-engine experience.



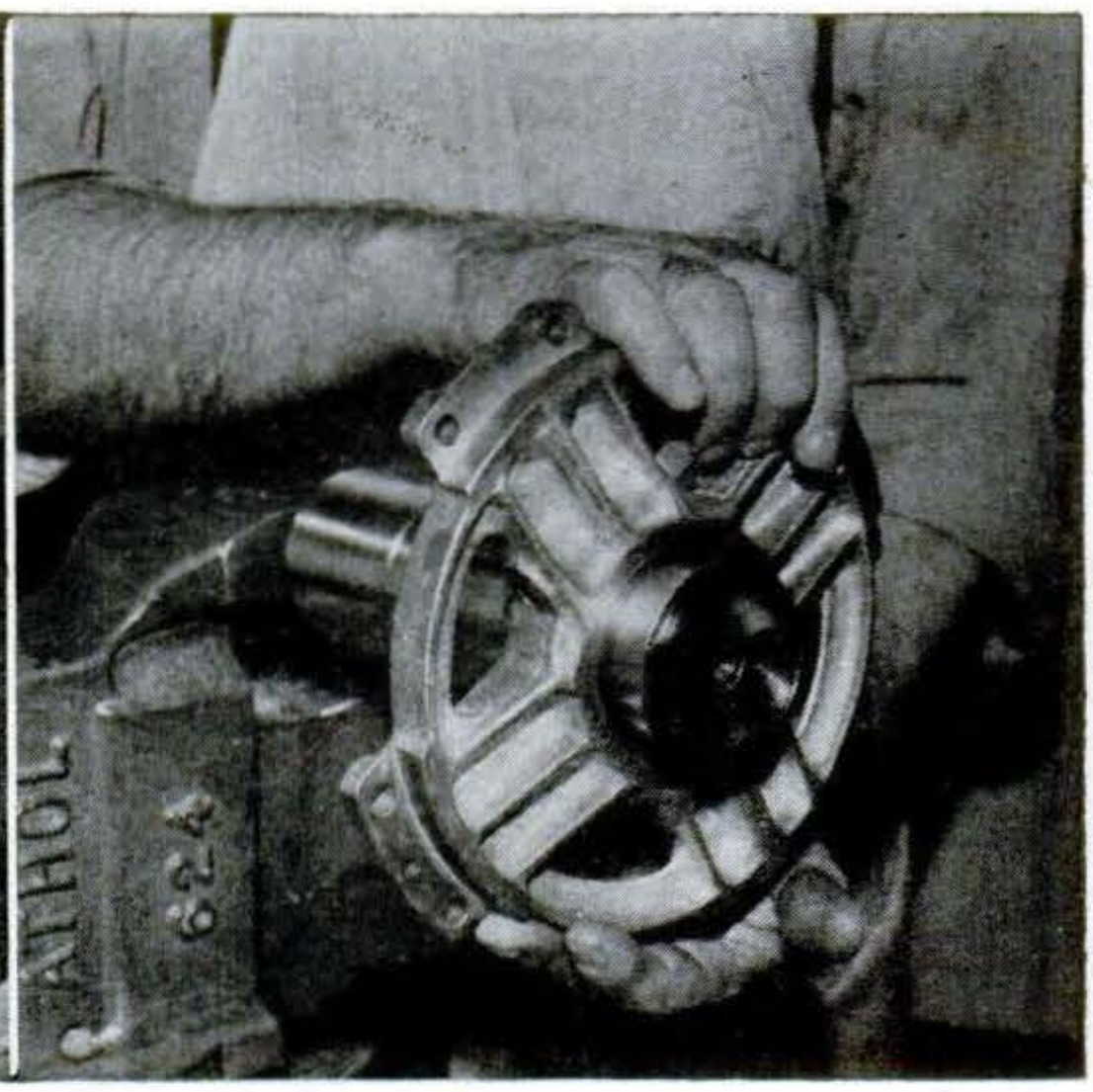
A relief groove is ground in an intake valve with a Carborundum wheel. There are two intake and two exhaust valves in each cylinder to handle the flow of fuel and exhaust gases.

Aluminum-alloy piston must be turned to exact diameter, 3.875 in. When finished each one must weigh exactly 24 oz. This engine, unlike most, has a bore that is greater than the stroke.



Connecting rods are machined from drop-forged steel. They must be as light as possible, yet strong enough to withstand stresses of 6,000 r.p.m. Here grooves are milled in shank.

Balance of moving parts is essential. In this photo, one piston, rod, and pin set is weighed against another set. Maximum difference allowed in the 80-oz. assemblies is 1/16 oz.



Five main-bearing supports are required. They are cast in two parts from high-strength manganese bronze and bolted together. After being turned, each is checked on a mandrel.

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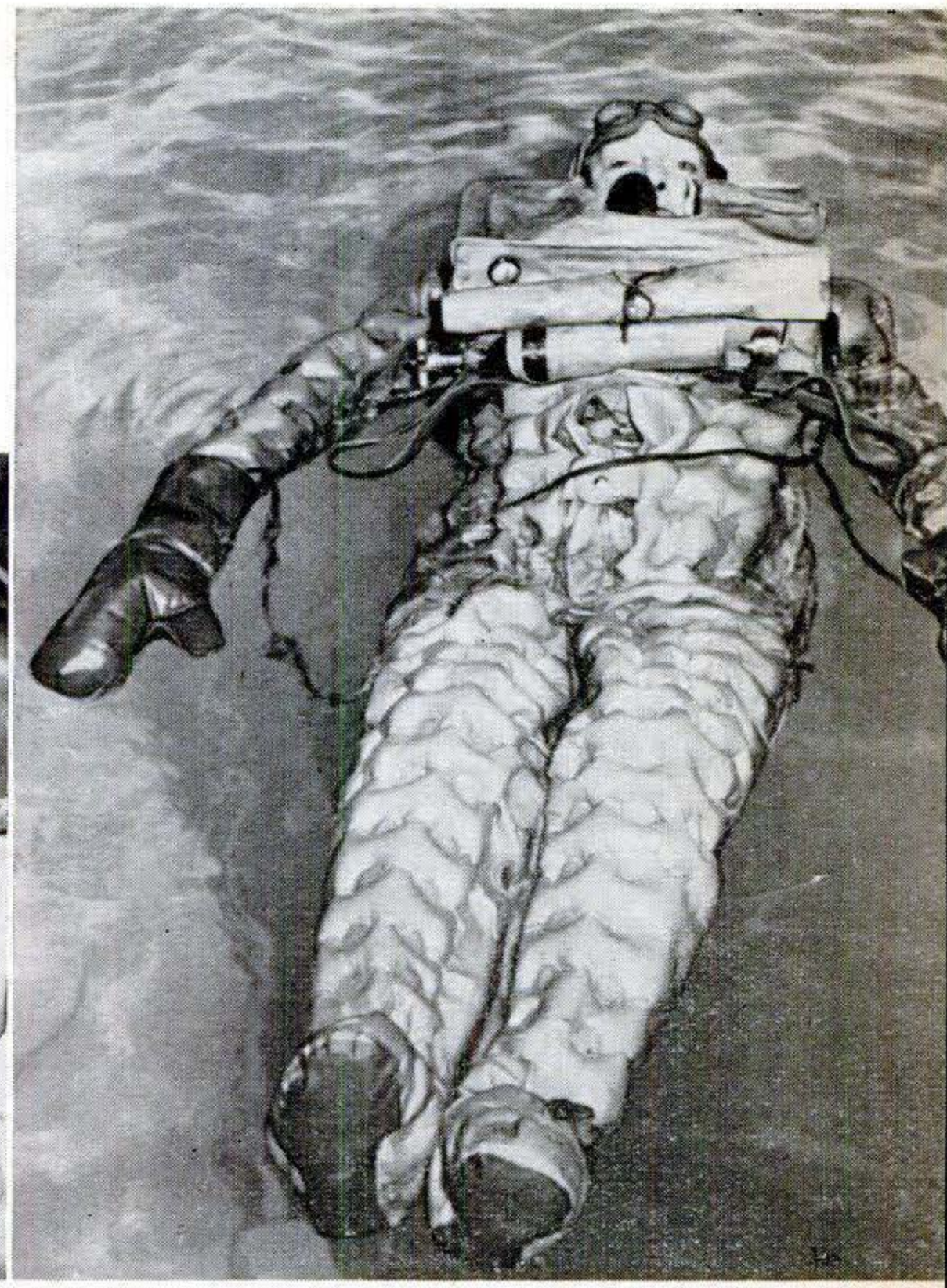
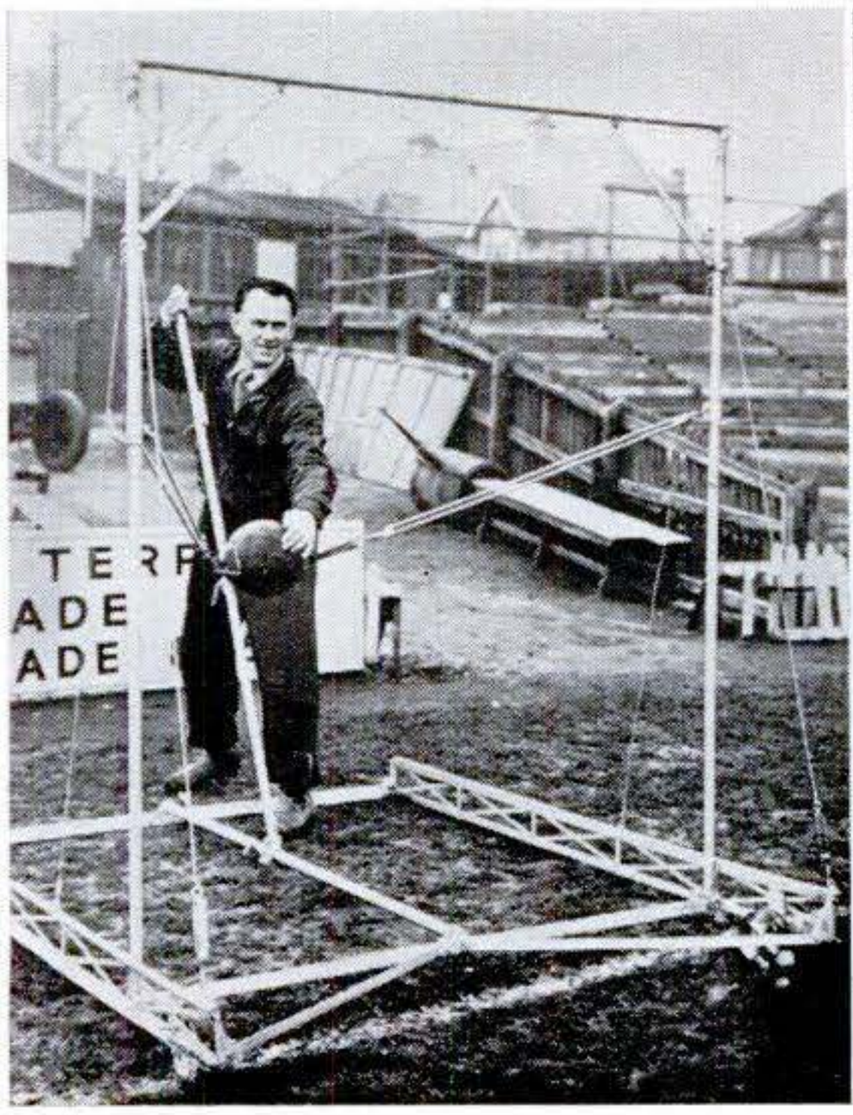
Escape Suit for Sub Crews

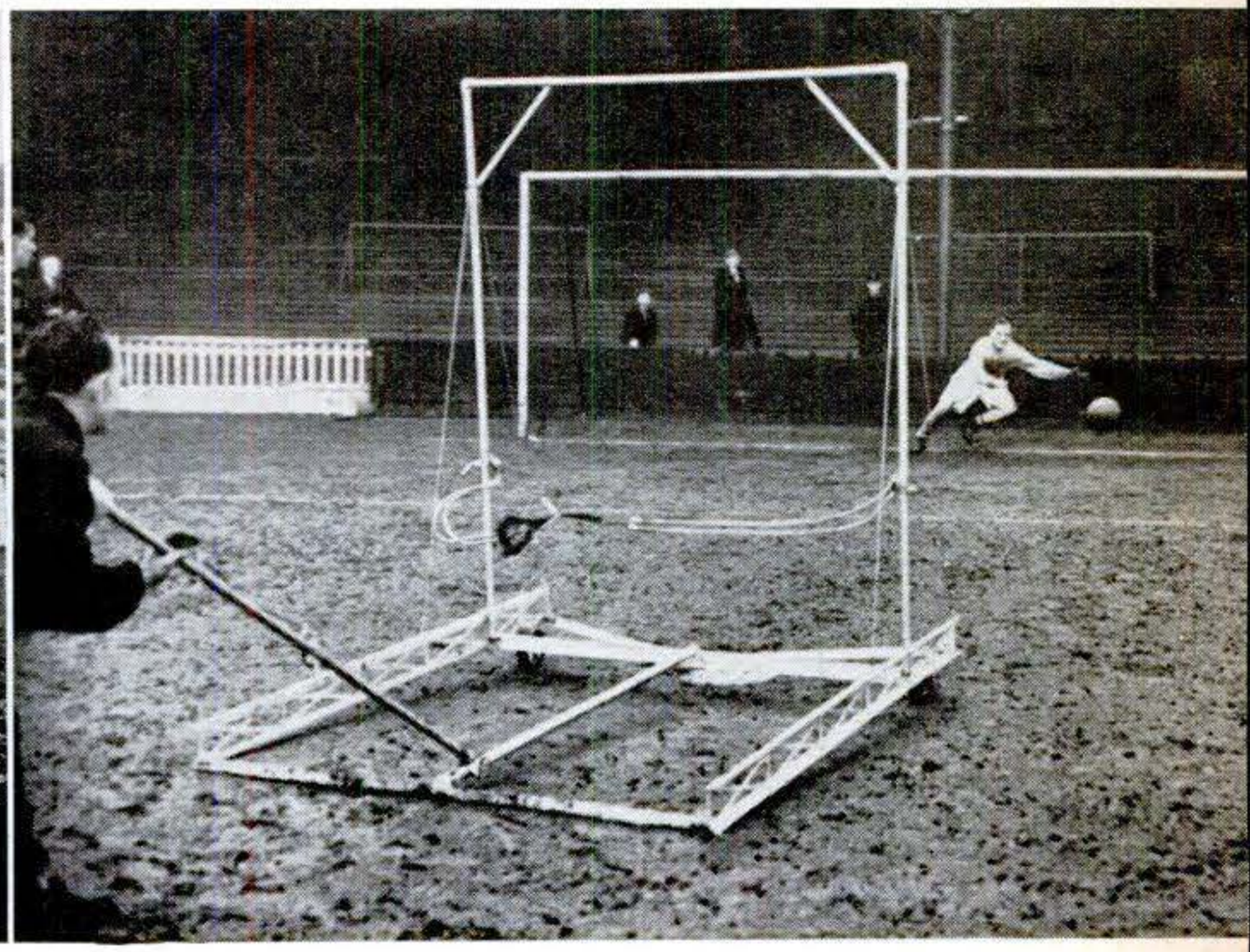
A NEW British immersion suit is equipped with a breathing device, below, for escaping from a submerged submarine. When the wearer comes to the surface, he inflates the 6-lb. rubberized-nylon suit, right, to provide buoyancy and protection from exposure. Attached to the shoulder is a lamp, operated by sea water, that burns 30 hours.



"Slingshot" Throws Practice Soccer Balls

BRITISH soccer teams are getting a mechanical assist from a new catapult that can throw practice balls accurately up to 50 yards at a rate of six a minute. You put the ball in the rig and fasten it to the long propelling stick, as shown in photo at left below. When the stick is pulled back, the catapult is drawn taut and sends the ball flying when released from the stick. Short or long throws are accomplished by sliding the propelling stick forward or backward along the horizontal bar at the base. Invented by a British soccer player, the machine also throws cricket- and footballs.





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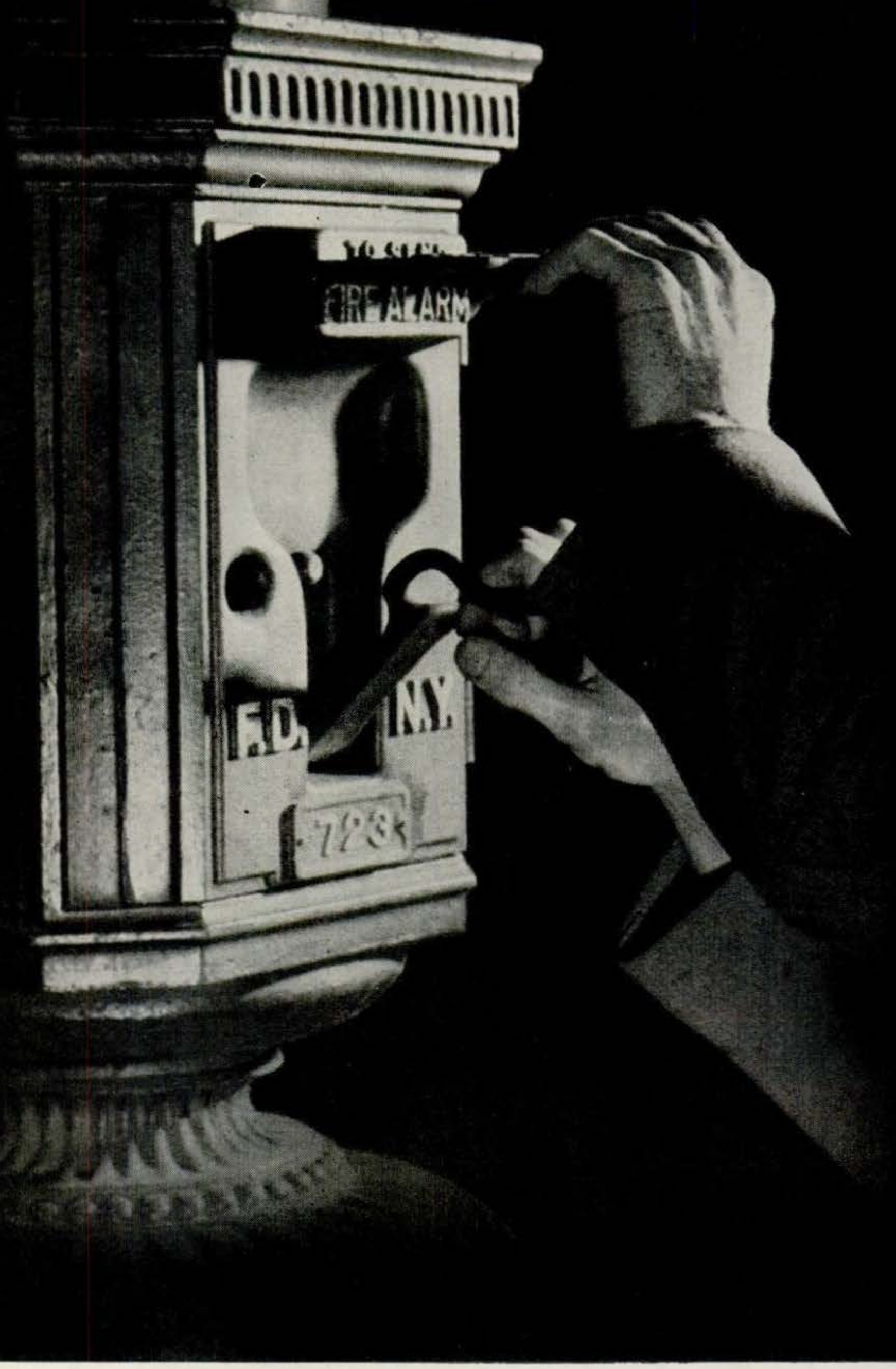
40-Second Drama:

What Happens When



FIRST ACT of the drama begins. An early morning passer-by spots a fire in a loft building near Herald Square, in the heart of Manhattan. Rushing to the nearest street box, he turns in an alarm by raising a covering handle and pulling down a lever, as shown above. It is 2:48 A. M. as a loud bell rings. That is only a local warning to alert the patrolman on the beat or a passing police squad car. What happens as wheels whirr and electrical contacts are made inside box 723 is shown on the following pages.

Copyrighted material

You Pull a Fire Alarm

Here's how the bright red boxes send the right engines to the right place —in less than a minute.

By Herbert Johansen

PS Photos by W. W. Morris

LAST year New York citizens turned in more than 60,000 fire alarms. Yet probably not one out of a thousand of those who pulled alarm boxes had any idea of the complicated mechanisms, electronic devices, and human activity he set in motion to start fire equipment rolling within 40 seconds.

On these pages POPULAR SCIENCE takes you behind the scenes to show you the dramatic story of a big-city fire-alarm system at work.

The statistics alone are exciting. New York City's fire-alarm system covers 320 square miles. It has 1,500 miles of underground cable—about 22,000 miles of conductor plus 1,700 miles of aerial circuit—feeding five borough central-telegraph-office nerve centers. At one end are 12,750 street and building fire-alarm boxes; at the other, 415 pieces of fire-fighting apparatus and 10,500 firemen.

Seeing the system at work, you are impressed by the protection against any possible failures, mechanical, electronic, or human. Everything has a standby—or even two or three.

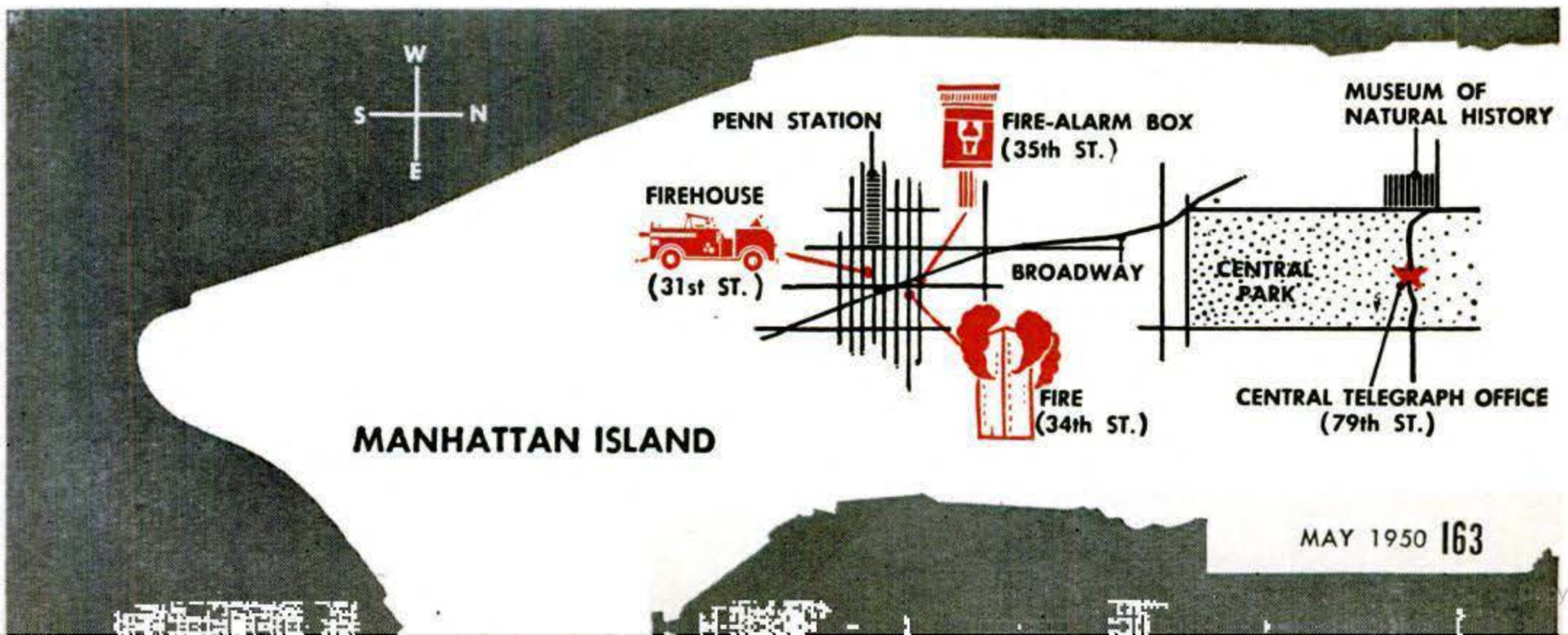
When a box is pulled, the code signal comes into the central office as flashing lights, as buzzing buzzers, and with a standby sounder device ready to take over. Malfunctioning of any circuit causes a trouble signal to come in on its central-office panel, dispatching a repairman. If a street box on any one circuit is knocked out of commission, it can be grounded in a matter of minutes, and the circuit split to make two circuits. This by-passes the broken box and keeps the others on the circuit working.

Every alarm is transmitted from the central office on two separate circuits, a primary and secondary, and comes into the firehouses on separate bells. Most N. Y. street boxes are of the noninterfering, "succession" type, so that a second box pulled on a circuit will not garble an alarm being sent in by a previously pulled box on the same circuit.

Take a look at the photograph of the succession mechanism. When an alarm is pulled and the circuit is clear, a pivoted succession armature is attracted to the poles of electromagnetic coils. This moves the armature's tailpiece, releasing a circuit breaker so that it drops into the teeth of a notched code wheel. But if another box on the same circuit is transmitting an alarm, the current is interrupted in the coils, and the armature falls away. This keeps the tailpiece in a position mechanically locking the circuit breaker, preventing it from dropping into the code-wheel teeth. No alarm is transmitted.

On every fourth round of the code wheel, however, the armature head "feels" its way toward the coils. If the circuit is clear, contact is made, the circuit breaker is released, and the box alarm is transmitted.

MAP BELOW shows location of the fire, box 723, the Manhattan central telegraph office in Central Park, and the firehouse pictured on following pages. Fire companies at other locations also respond.



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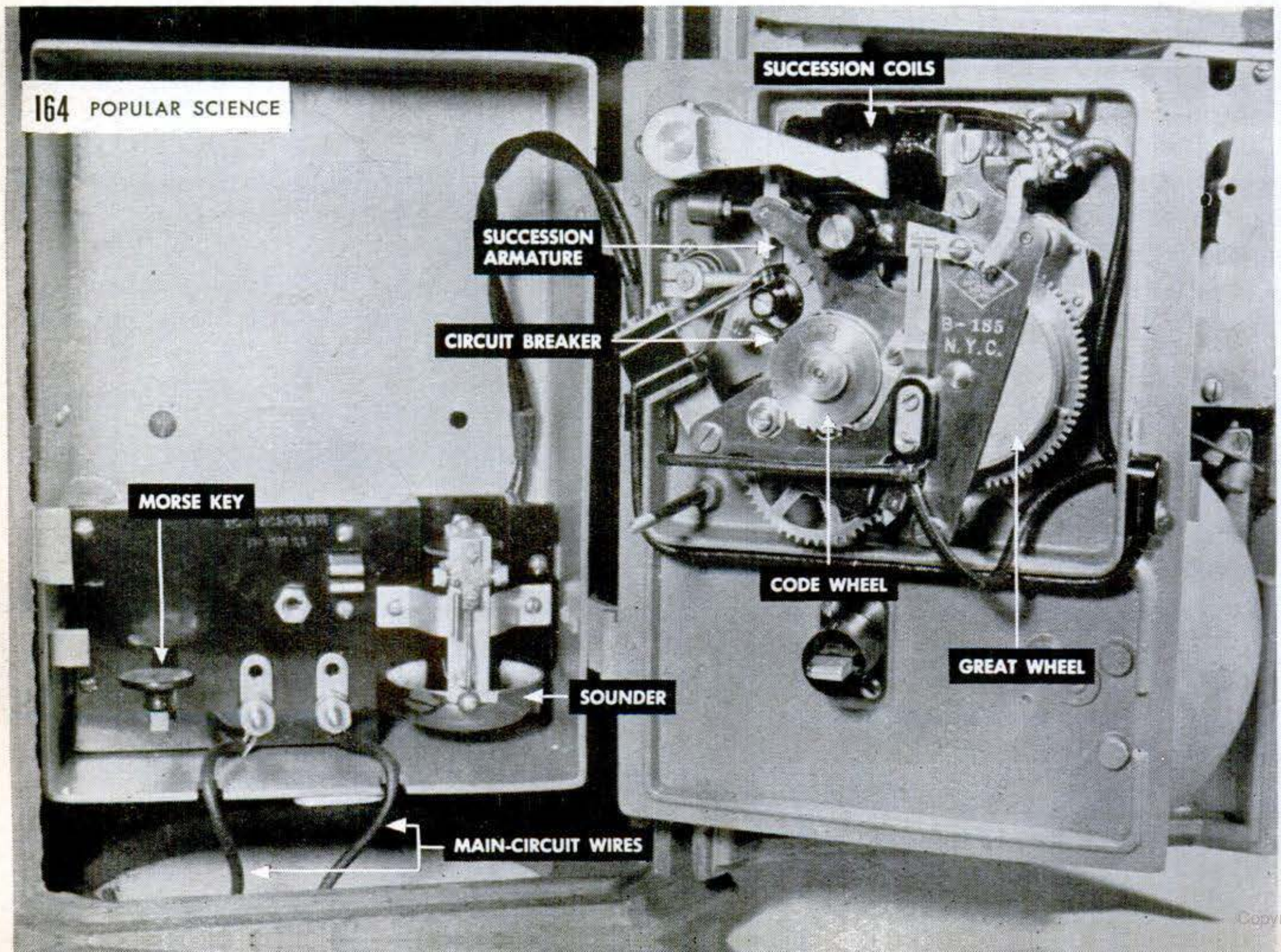
PULLING THE ALARM forces down the inner pull lever, which in turn depresses the box pull lever, starting the mechanism at right below. A fraction of a second later, it releases the clapper, sounding the local-warning bell. Spring-wound great wheel, below, has started to run, rotating the 723 code wheel. At the same time the electromagnetic succession coils have been energized, holding the succession armature, and freeing the circuit breaker. As the latter drops into the code-wheel notches, it breaks the closed main circuit seven times—two times—three times. This code signal is received instantaneously at the central telegraph office, identifying and locating the street box. If another box on the same circuit had been pulled, the current in the succession coils will be interrupted, and the succession armature will fall back from the coils. This holds the circuit breaker back, and the code wheel rides free until the other box has sent in its alarm and the circuit is free for box 723 to go into action.



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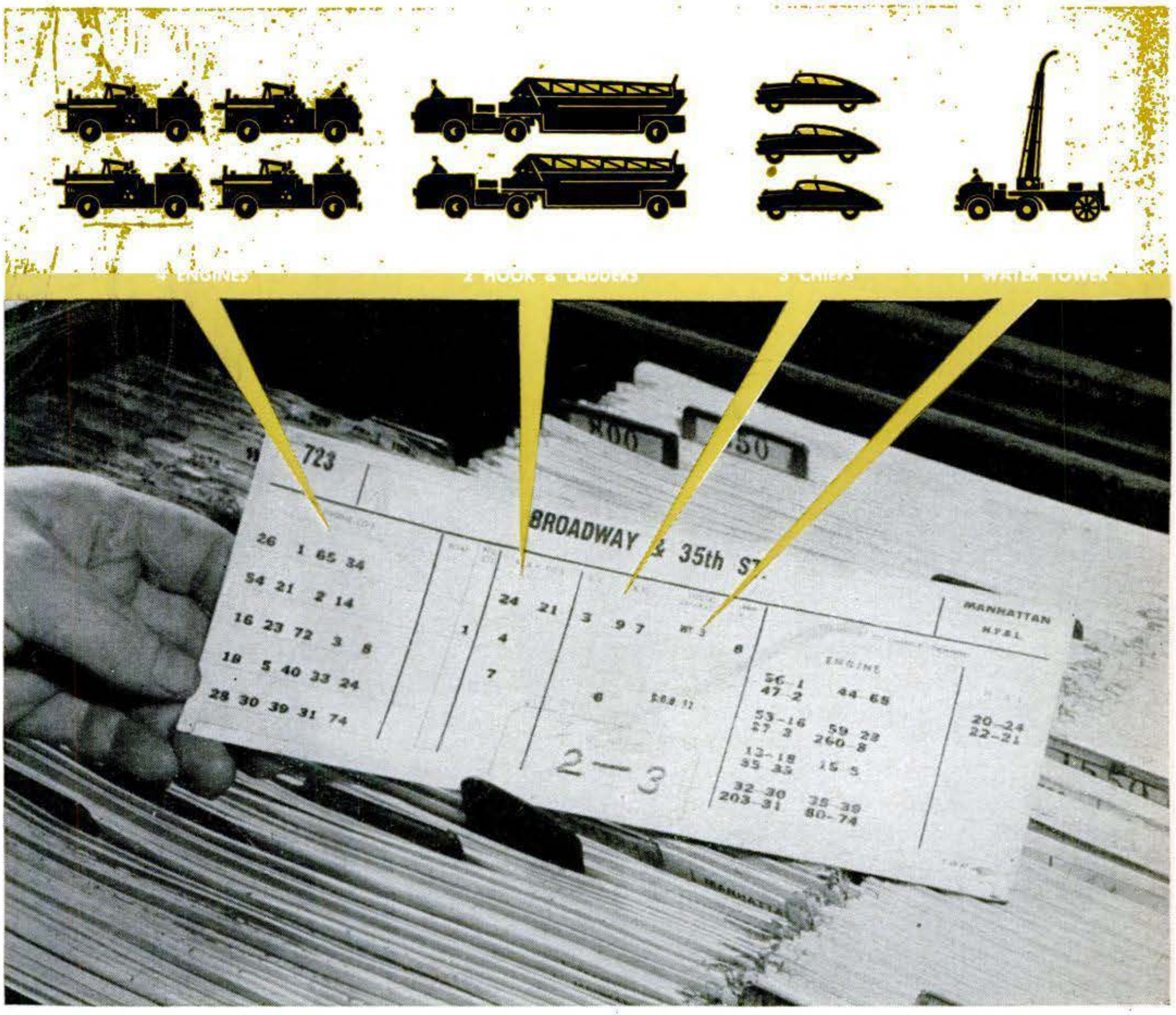
COMPARED IN SIZE with a fireman's badge are a code wheel, the heartbeat of every fire-alarm box in New York City, and an 80-conductor underground cable with a capacity of feeding 60 circuits, or 600 boxes, linking them with the telegraph nerve center.

SECOND ACT takes place in the central telegraph office, also at 2:48 A. M. As one dispatcher, above, identifies the buzzes and flashes on the receiving panel as 7-2-3, another dispatcher rushes to a file box and pulls out the 723 assignment card.



ASSIGNMENT CARD for fire box 723 locates it at Broadway and 35th St. (Herald Square). The numbers across top line identify companies and types of equipment that will be sent out on the first alarm (pictorialized on panel at top). Main interest of the dispatcher is, first, to check a log to see if any of the companies are already out on an alarm, in which case he may have to make substitutions; and second, to check zones—2 and 3 here—to set up the Selective Alarm System on a special console.

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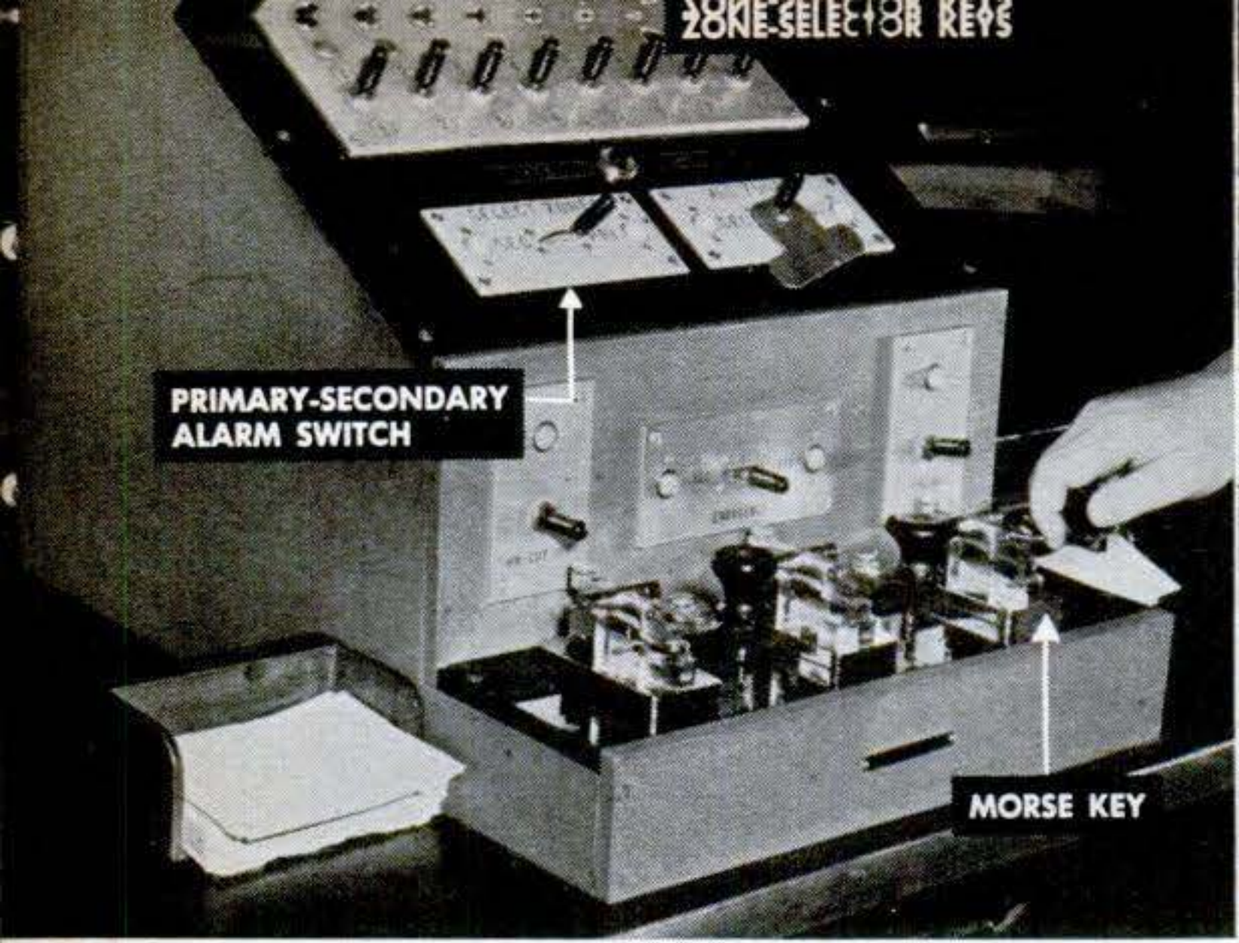
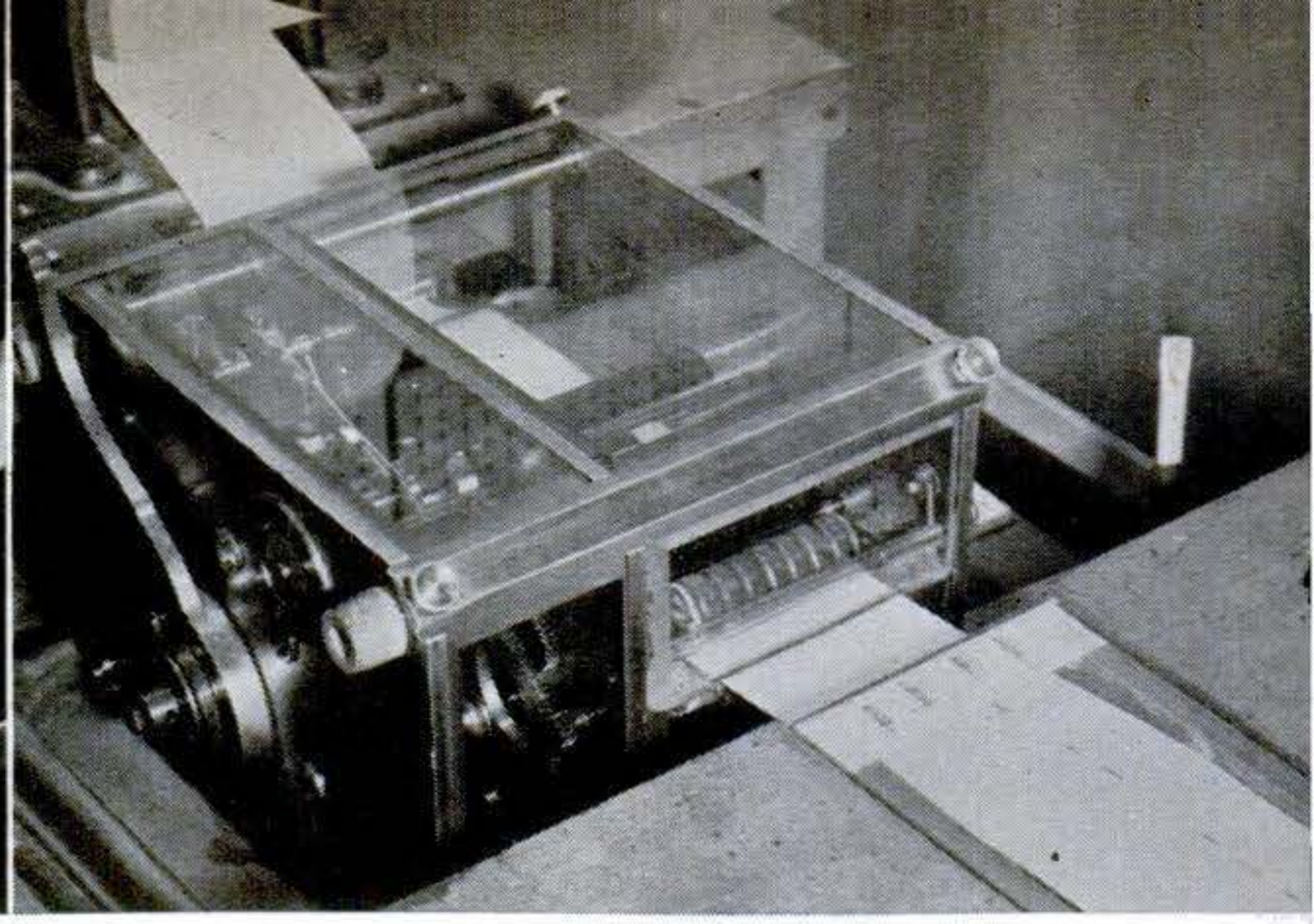
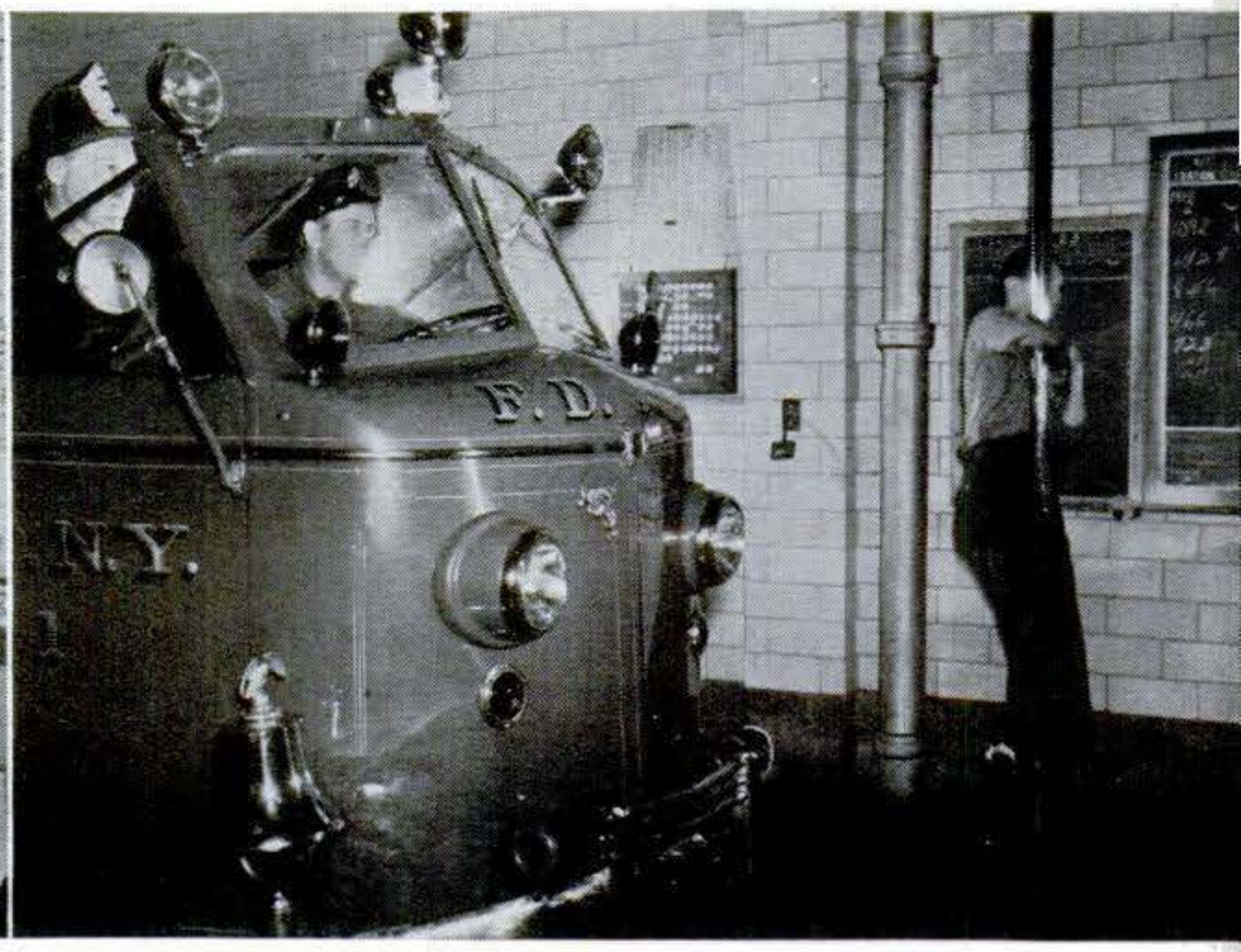


AT 2:48 AND 30 SECONDS, 7-2-3 is tapped out on the Selective Alarm transmitting console. As the dispatcher has pressed zone selector buttons 2 and 3, however, the signal will be tapped out only on gongs in the quarters of companies that will roll on this alarm, or alerted to go on a second alarm.



AS THE 7-2-3 COMES IN at the central telegraph office, it is repeated automatically as coded dashes on a moving tape by this machine in the radio dispatcher's room. It records alarms not only from Manhattan, but those received in central telegraph offices in other boroughs throughout the city.

THE SIGNAL has been tapped out on repeater bells in all parts of the firehouse as the watchman above flips a switch that will ring a loud bell atop a pole at Seventh Avenue and 31st St. This alerts the traffic policeman on duty at one of New York's busiest corners to clear the way for the fire apparatus.



YES, FIREMEN STILL SLIDE down poles—it's the fastest way of getting down from their quarters. And at this stage of the drama split seconds count. An engine, with the lieutenant next to the driver, is all ready to roll, its bell clanging loudly to warn curious pedestrians away from the doorway.

If there is still interference, the armature head moves back for another "wait."

Until recently, all first alarms were sounded in every firehouse in a borough, although only a small fraction of the companies were assigned to respond to any particular alarm. This needless clanging kept the firemen constantly on edge, counting to see if this was it. For, as Chief Thomas P. O'Brien, head of the New York City Fire Alarm Telegraph Bureau, says, "a fireman's heart and head is attuned to a gong."

To eliminate this condition, the department installed the Selective Alarm System. Now Manhattan, for instance, is divided into eight zones, so arranged geographically that all companies that will respond to any first alarm are located within one or two zones. Before an alarm is transmitted by the dispatcher, he first selects the zones involved on a special selector console, boosting the current so that gongs will sound only in companies that will roll on the first or second alarm. In other houses, the alarm comes in as an almost inaudible clicking. On second and subsequent alarms, the selective feature is turned off, and all companies get the gong.

Twice a month, however, comes a signal that needs no selective service—the three deuces—2-2-2. It means: "The pay checks are ready; come and get them." END

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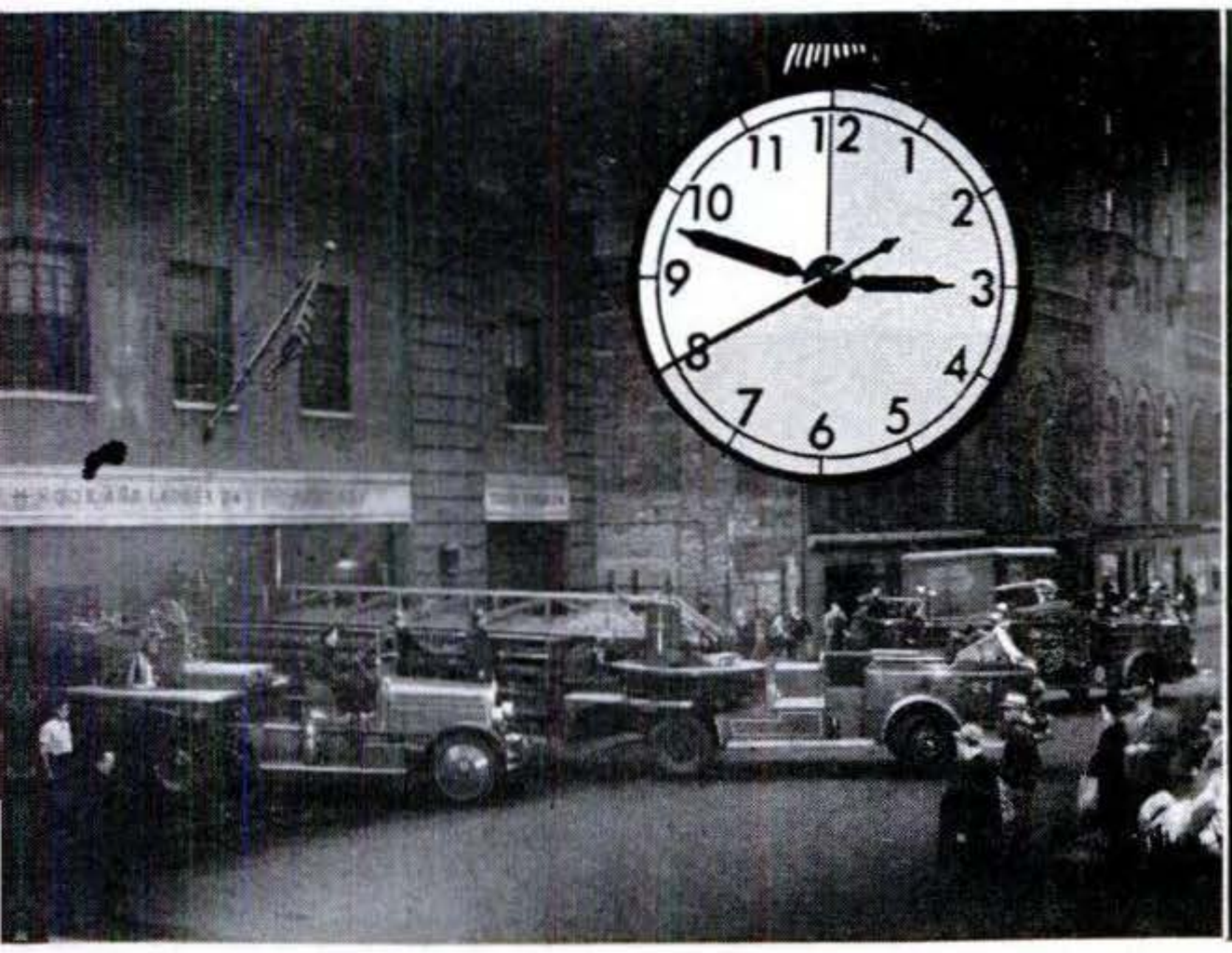
THE FIRE DEPARTMENT'S RADIO STATION KEA-292 is on the air. The dispatcher has checked the recording tape and pulled out his 723 assignment card. After sending out a tone signal to alert all receivers tuned in to his station, he announces the box number and its location, Broadway and 35th St.

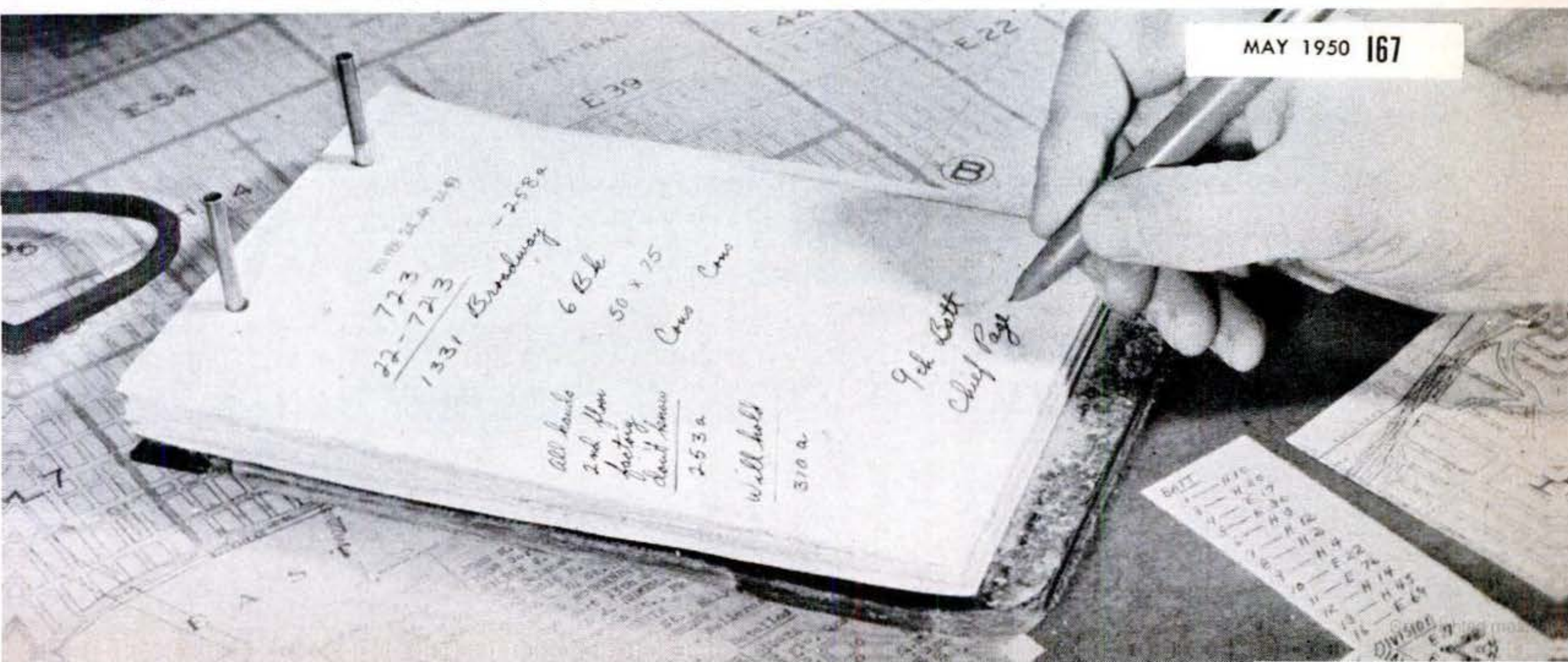
ACT THREE opens in a firehouse at 31st St., near Seventh Avenue, with gongs tapping out the signal 7-2-3. Here the house watchman already has noted the box number and time on a blackboard, and is scanning the assignment card to check the location of the box and see what equipment will roll.



ACT FOUR: the engines roll—just 40 seconds after John Q. Citizen pulled street box 723. The chief has already gone. Here come engine, hook and ladder, and water tower, the assignment card's listing for this firehouse. A searchlight unit, dispatched only after sunset on a second alarm, is still in the house.

BACK AT BOX 723, Battalion Chief Page decides he needs more equipment to fight the blaze. He opens the box and taps out 2-2-723 on the Morse key—the code for a second alarm. It is received in the central telegraph office like the original alarm, but is transmitted to all companies in Manhattan.

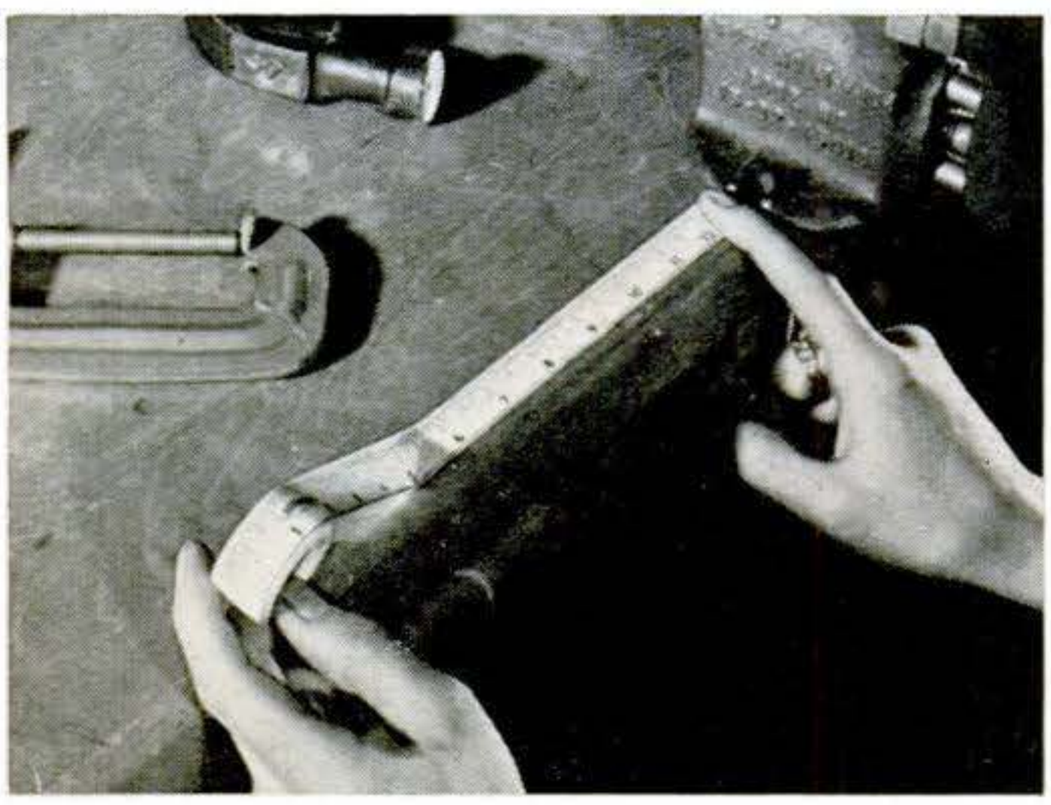
DISPATCHER'S PAD tells complete story of the 723 alarm, from its first receipt at 2:48 A.M., to the final "Cons" entries reporting considerable damage to a six-story, 50- by 75-foot brick building and its contents. "All hands" in preliminary report, phoned in at 2:53 a.m., means that the chief was keeping all the first alarm equipment: "don't know" that he might need more, or to alert for a second alarm. The second alarm was turned in at 2:58. At 3:10, the battalion chief reported that the fire was under control.



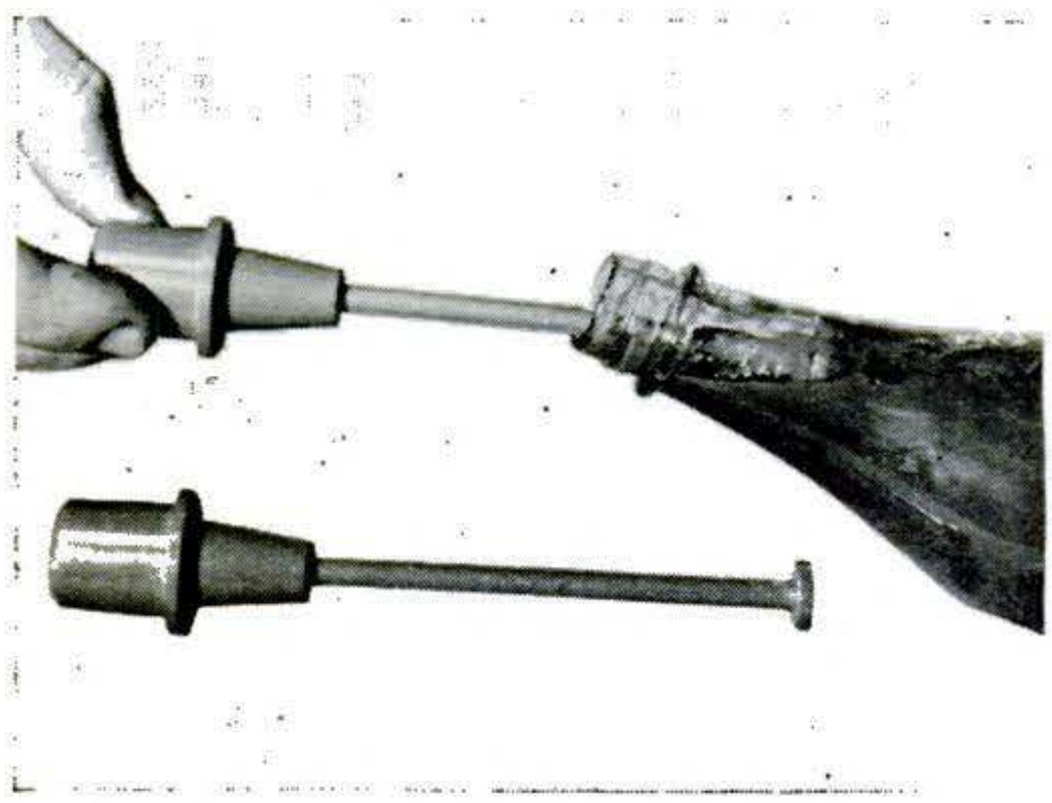
Aids to Modern Living

Shelf Swings Down. For installation over a conventional closet shelf, this auxiliary ledge can be pulled forward and downward so you can reach it, as shown in inset above. Space Saver Industries, of Detroit, sells cadmium-plated shelf hinges and a handle, which are screwed to a 10-inch board. Fittings are priced at about $4.

Lawn Trimmer Has Foot Grip. With your foot held firmly in the stirrup of this new gardening tool, you can use the full weight of your body in a rocking motion to trim lawn edges neatly and with little effort. The trimmer's cutting edge is made of tool steel. Calida Specialties Corp., of Long Beach, Calif., makes it.



Ruler Sticks to the Job. With this roll of laminated adhesive tape, imprinted with five 12-inch rulers, you always have a measuring stick handy. Just press a ruler length against a working surface, as shown, and cut it off. Then your hands are left free for working. Stik-E-Ruler, of Watkins Glen, N. Y., prices the roll at about 40¢.



Bottle Stopper Serves Catsup. When you use a plastic stopper like this one, you don't need to resort to bottle-slapping to make sluggish catsup pour. A disk on the end of the stem lets you draw out the sauce without splashing it. The air-tight Catsup Draw® stopper is priced at 60 cents by the Phelps Co., of Portland, Ore.

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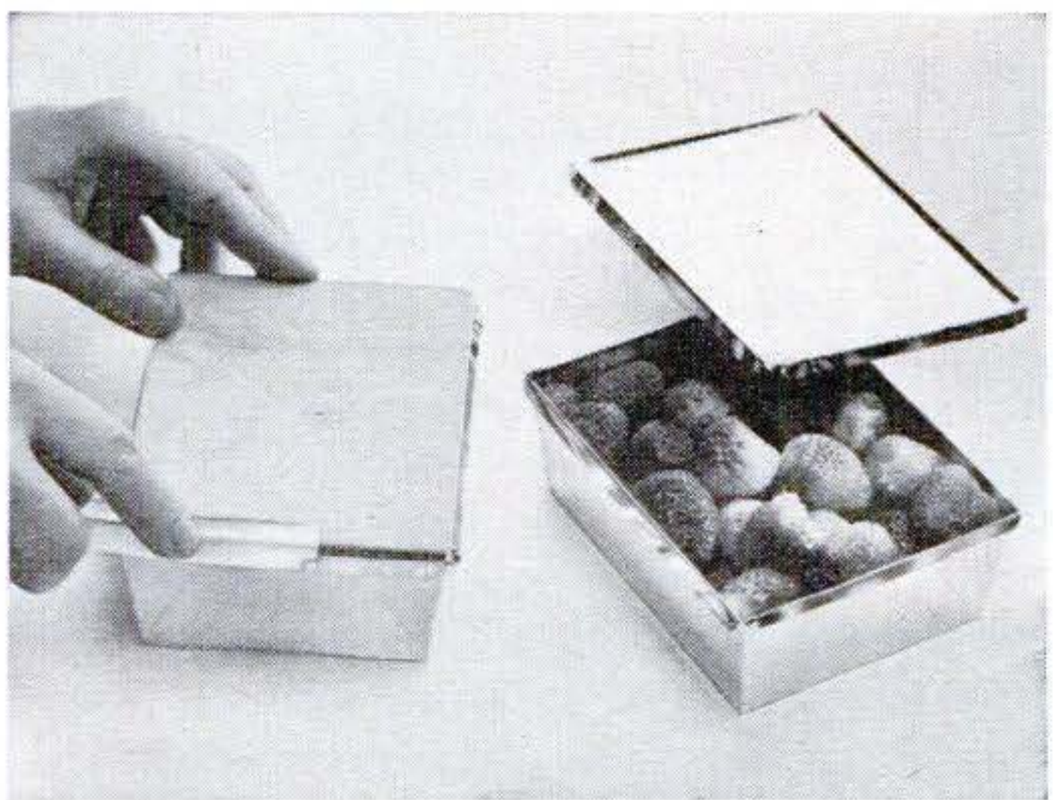
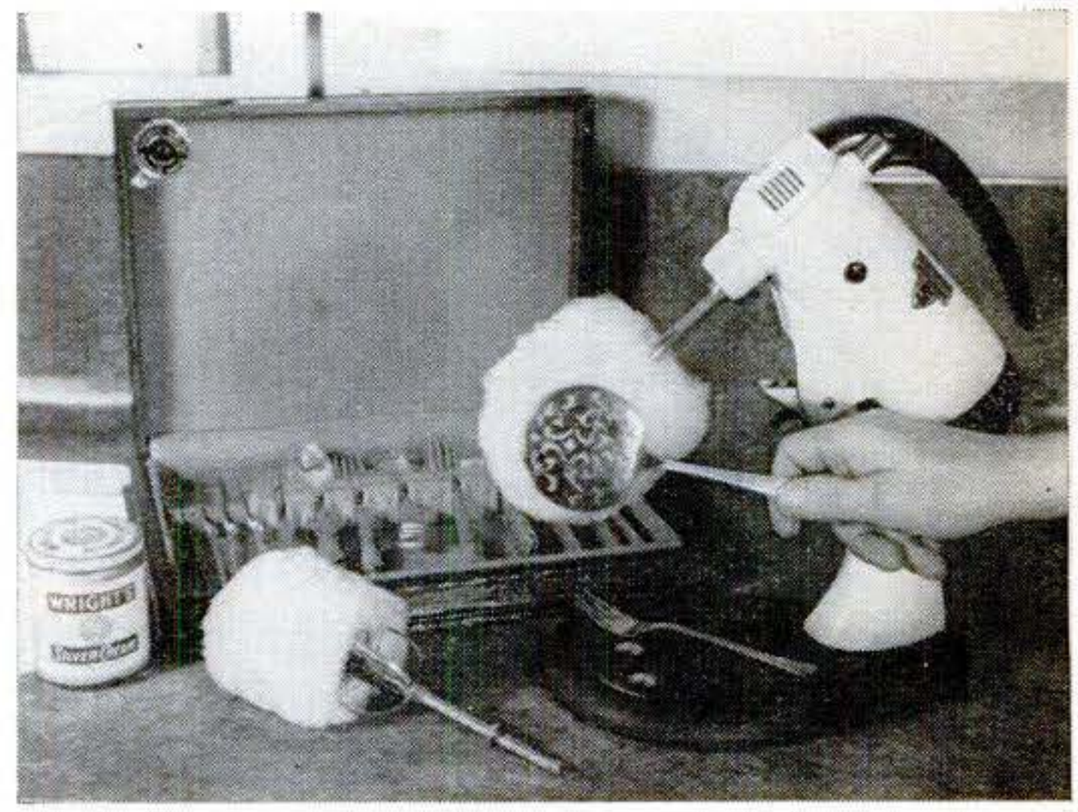
Plastic Strip Covers Cracks. Tub-Kove®, a flexible plastic strip, seals the crack between bathtub and wall, preventing steam or water from damaging inner surfaces. When coated with vinyl cement, the tape adheres to porcelain, wood, and other materials. Keller Products, of E. Cleveland, Ohio, makes a kit that sells for about $3.00.

Ladder Gripper Holds Paint Can. Clamped to a stepladder, this metal gripping device keeps a tight hold on a paint can or scrub pail, preventing the container from falling off or spilling when the ladder is moved. Called Ladder-Grip®, the gadget is manufactured by the Die-Co Company, of Peekskill, N. Y. It is priced at about $1.



Aluminum Tray Stores Frozen Foods. A housewife can package foods for freezing and later cook or bake them in the same aluminum container. The covers of these re-usable boxes are clamped in place with a special tool, as above. Made by Reynolds Metals, of Richmond, Va., 25 pint or quart trays cost $1.60 to $2.70.



Mixer Polishes Silver. When a lamb's wool buffer is slipped over the beater of your electric mixer, as shown above, you can use the machine to polish silver, shoes, furniture, and even the family car. Curly Head® is available from the W. E. Norton Company, of Portland, Ore., for $1.50. Soapy water will clean the buffer.

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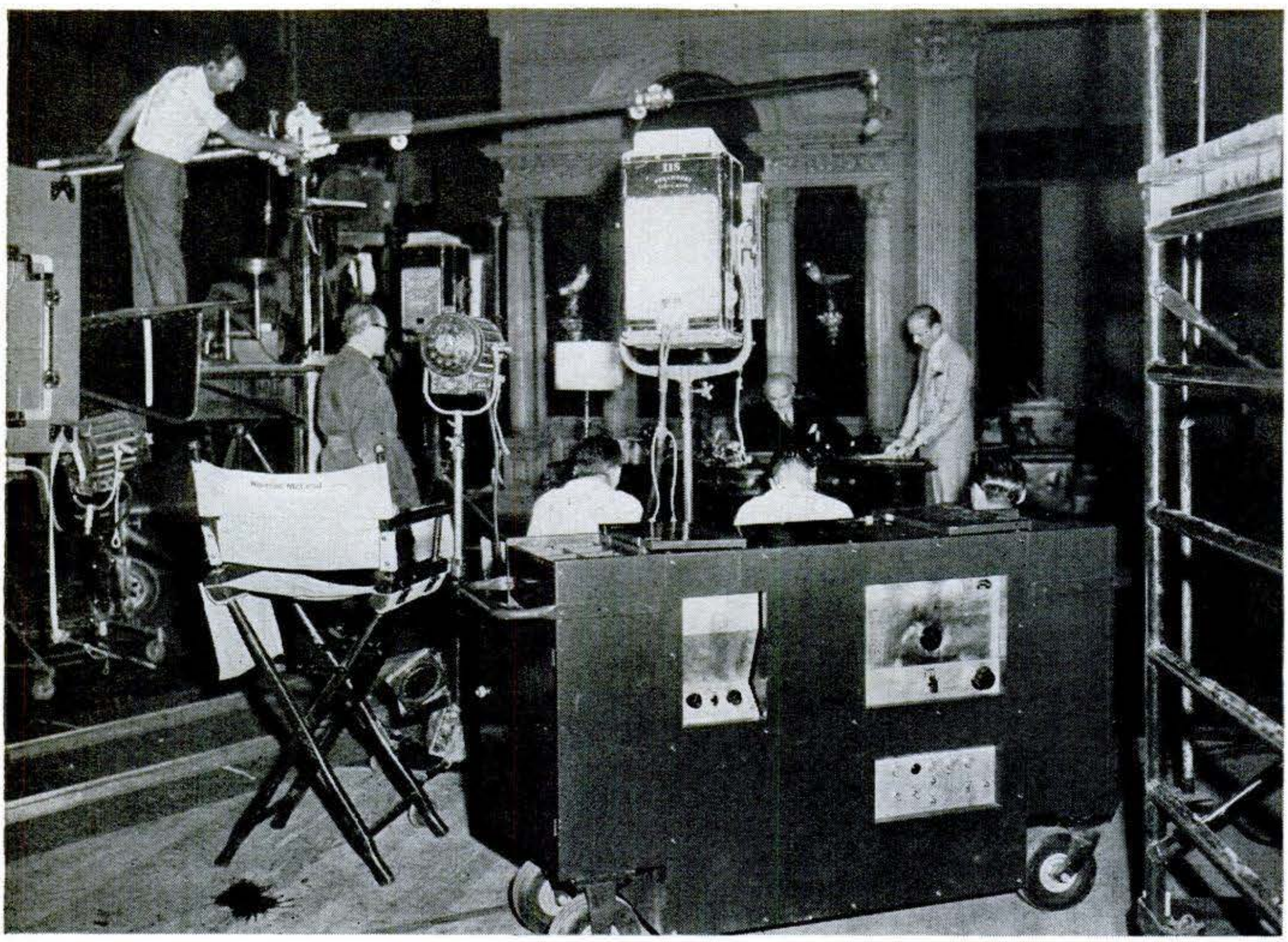

Radio cuing helps musical pictures by providing accompaniment for dancers and singers. In photo above, made during actual production, Fred Astaire (far background) listens to record over his concealed receiver. Music the audience hears is added later. Transmitter is in foreground.

Radios Whisper Cues to Actors

EVER since talkies made the movie directors give up their megaphones for shouting stage directions, they've been longing to get them back. Now two Paramount Pictures sound engineers have developed a 1950-model "megaphone" that lets a director prompt actors—yet keeps his cues out of the sound track.

The system, devised by Bruce H. Denney and Robert J. Carr, is actually a small broadcasting station. The actors listen in on tiny radios concealed under their clothing. When an actress wears a costume that barely gets by the censors, a still smaller set can be hidden in her hair.

The tubeless, batteryless receivers—so cheap they are thrown away if they go bad—use germanium-crystal detectors. The parts are mounted on cardboard 1¾ inches long and connected to a loop antenna that usually hangs around the actor's neck. A hearing-aid earphone is pinned under the clothing, and its sound is piped to the actor's ear through thin, flesh-colored plastic tubing.

Such simple receivers can be used because they are always very close to the 100-kc. transmitter's antenna—a loop of ordinary household wire circling the stage.

Besides relaying the director's whispered cues, the radio prompter helps out in musical scenes. In "The Furies," for example, 50 couples danced to music from a record they heard over their miniature radios. This prevented music from drowning out the dialogue, which could be recorded against a background of silence. The music was dubbed in on the sound track later. In another picture Bing Crosby had to sing while walking outdoors. He listened to a piano accompaniment over his concealed receiver while the distant pianist heard him over the sound-recording system. END

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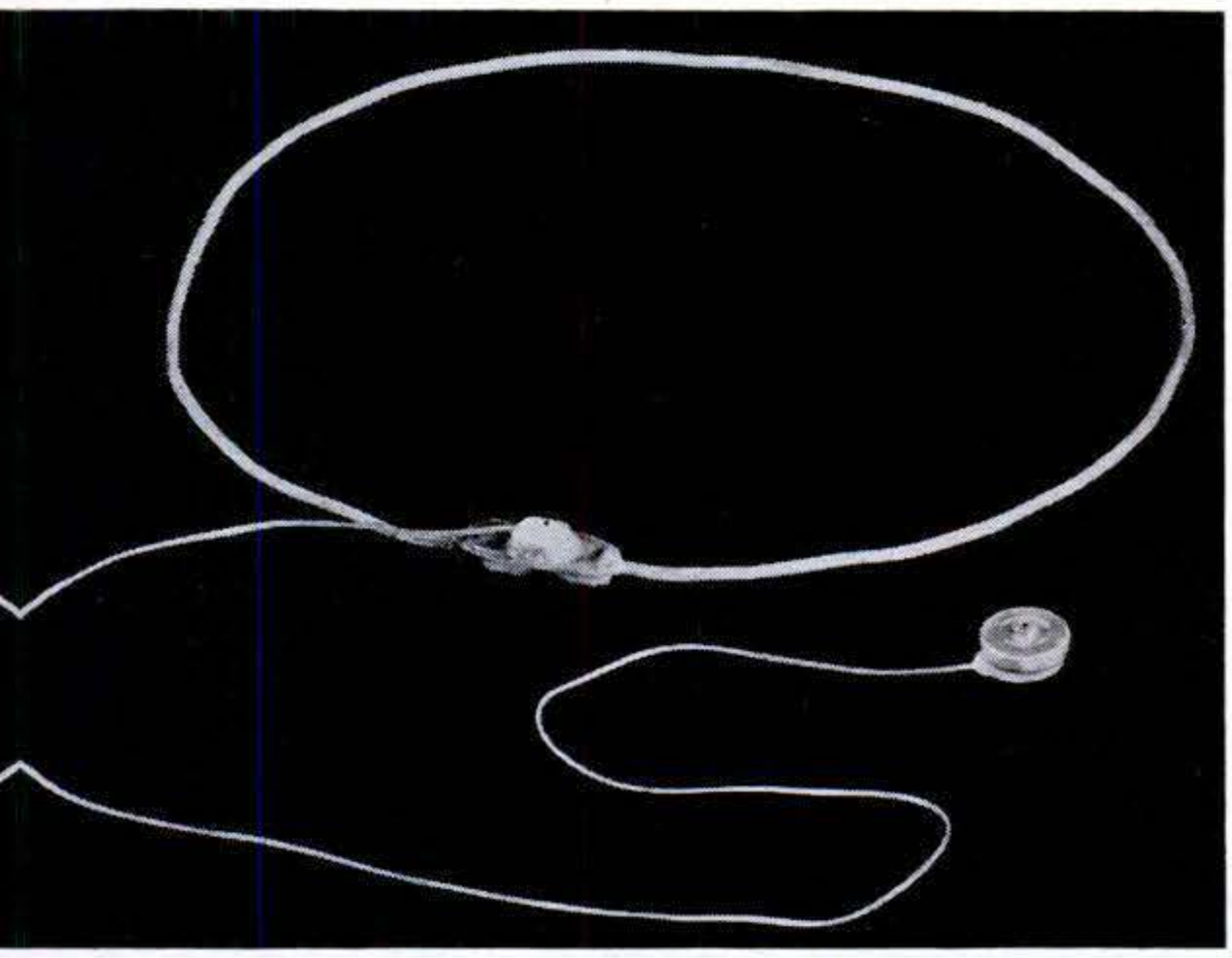
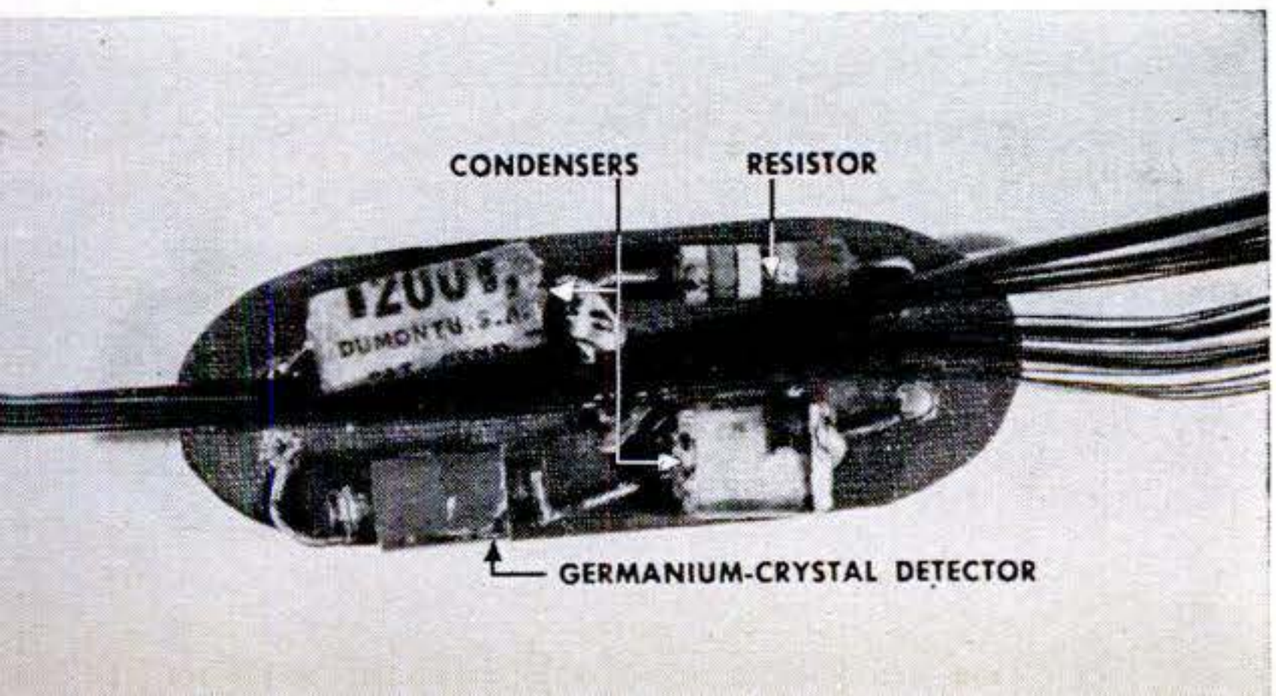
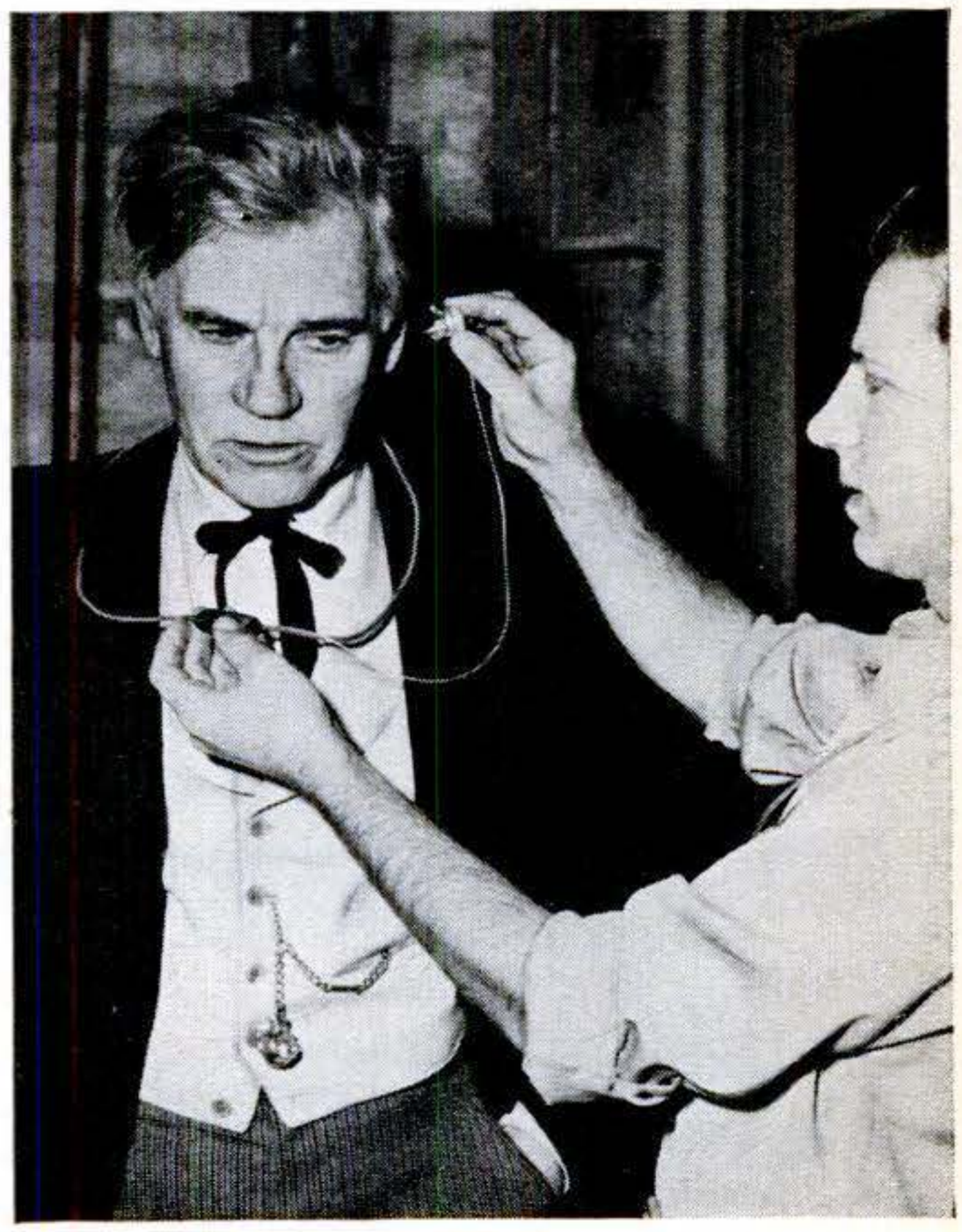
Dolly-mounted transmitter, shown open above, feeds loop antenna surrounding the stage. Radio-frequency field inside loop is strong enough to induce signal in the receiver antennas. Outside the loop, practically no signal exists. The broadcasts don't interfere with sound-recording.



This is what actor wears. Heavy wire—the antenna—goes around his neck. Thin "wire" is actually plastic tube carrying sound to earpiece. Close-up below shows simple receiver.





Walter Huston, one of the principal players in "The Furies," has his cuing radio adjusted by a Paramount sound man. Before shooting starts, the set will be concealed under his clothing.

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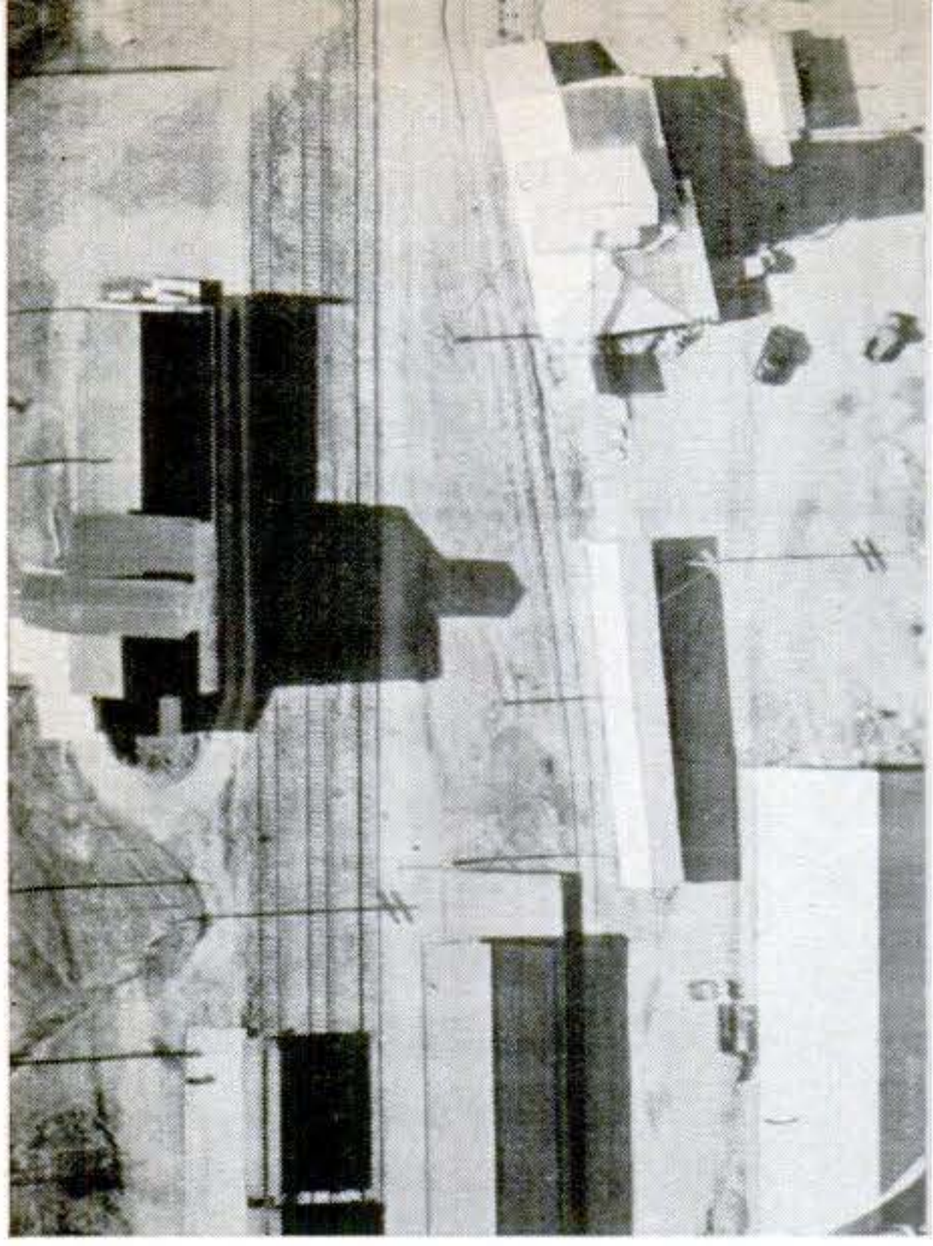
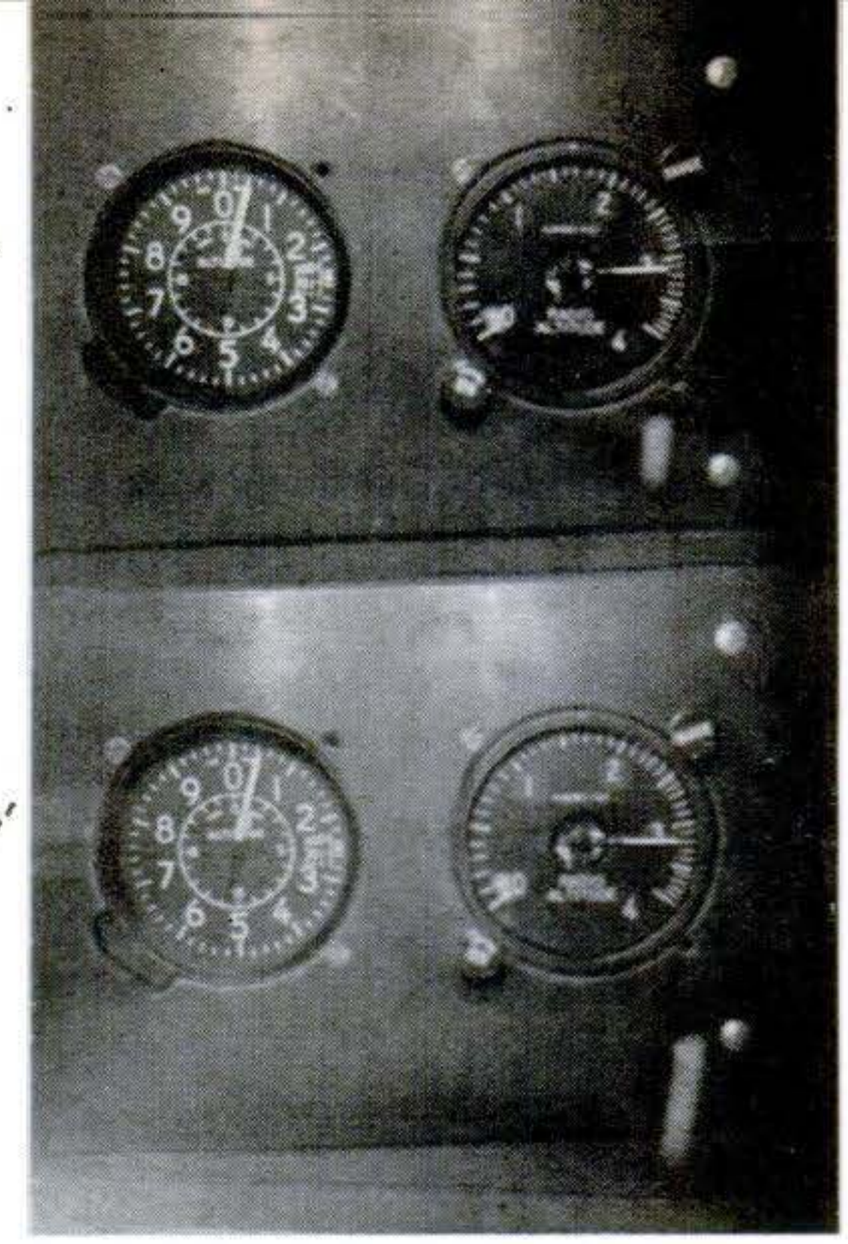




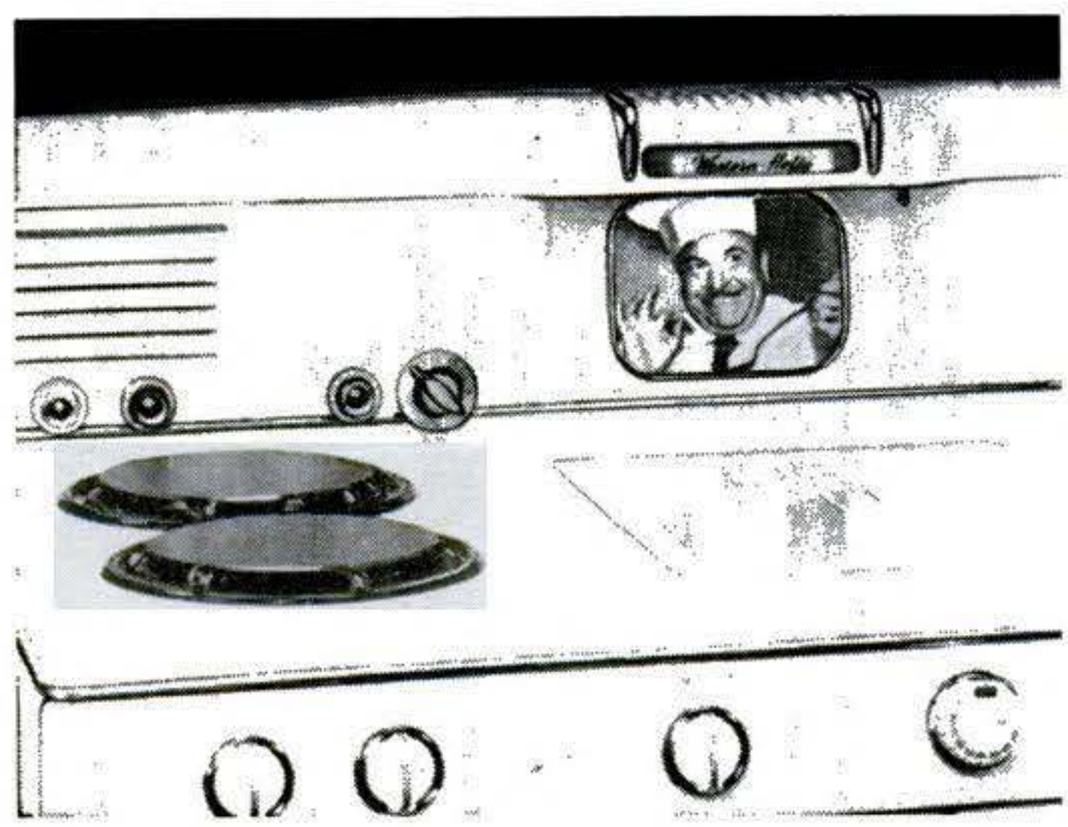
FM Radar Helps Planes Survey Ground Elevation

By combining a new kind of radar altimeter with aerial photography, oil companies now make complete pipe-line surveys at airplane speeds. Formerly, land elevations along a proposed route had to be measured by slow-moving ground surveyors.

The new Photo-Radalt camera developed by Midwest Aerial Surveys, of Tulsa, makes a strip picture of the ground under the plane (left above) and at the same time records the readings of two altimeters (right). The left-hand altimeter is the ordinary type that shows the plane's altitude above sea level; the other uses FM (frequency-modulated) radar, vastly more accurate than ordinary radar, to measure the plane's height above the ground. Subtracting one reading from the other gives the ground elevation.

Air Power—Midget Division

One of the sights at recent Miami, Fla., air maneuvers was this winged mite, claimed by its builder, Raymond Stits, to be the world's smallest airplane. It has a wingspread of 9 feet 5 inches, and is 11 feet 4 inches long, weighing 398 pounds. A 75-hp. Continental engine gives it a cruising speed of 150 m.p.h. The tiny plane is entirely fabric-covered, takes off in 400 feet, and has climbed 800 feet a minute to an altitude of 1,800 feet. Its only brake is a bicycle hand-type built into the tail wheel.



This TV Set Cooks, Too

With this new television set you can follow a telecast cooking program step by step—the TV screen is built right into the stove. The new Western-Holly® kitchen range has a seven-inch video screen in its back splash. Sound comes from one of the vents, and the chassis can be placed behind the stove or in the storage compartment. The maker is Western Stove Co., Culver City, Calif.

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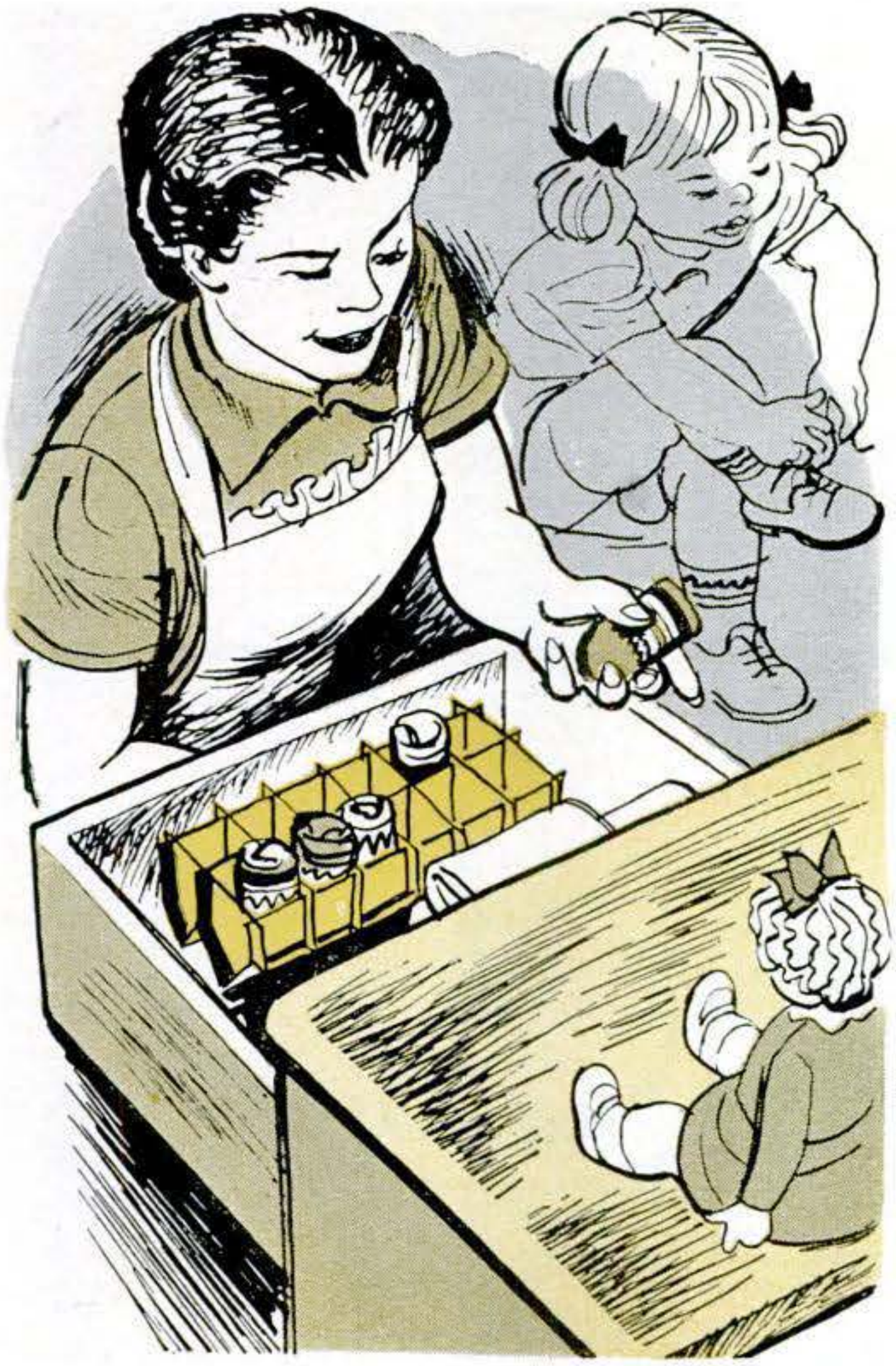
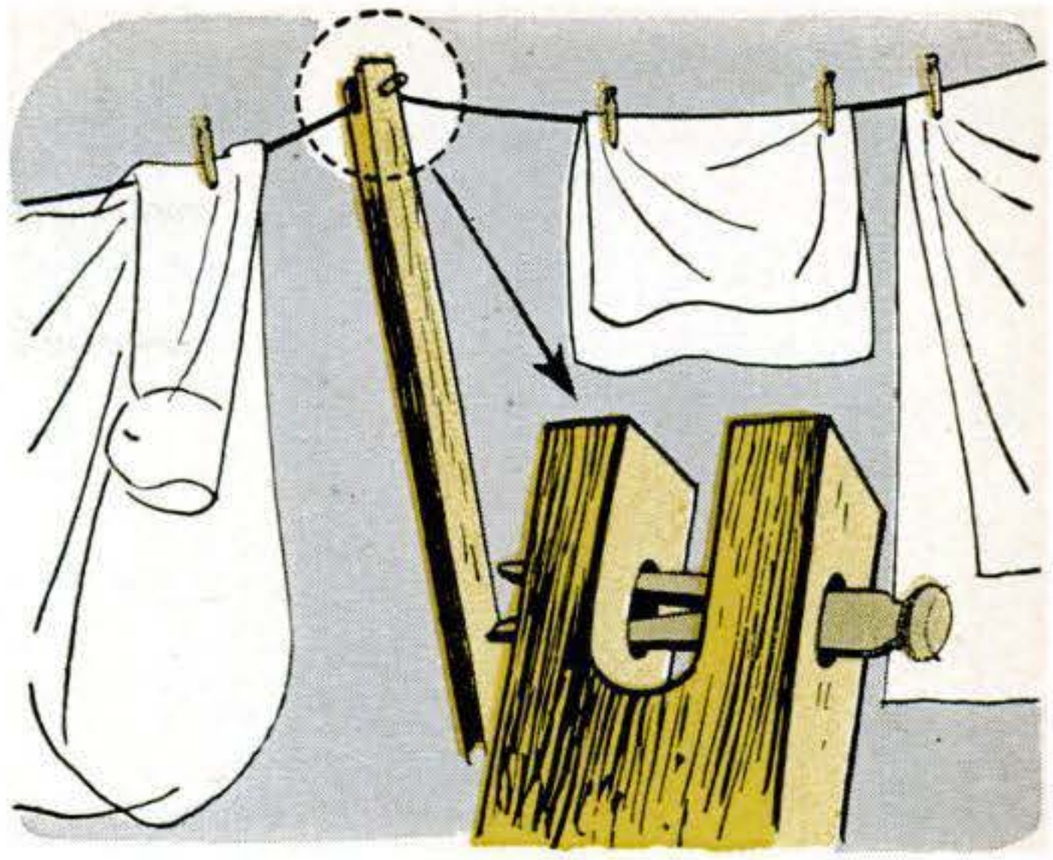
Keeping the Home Shipshape



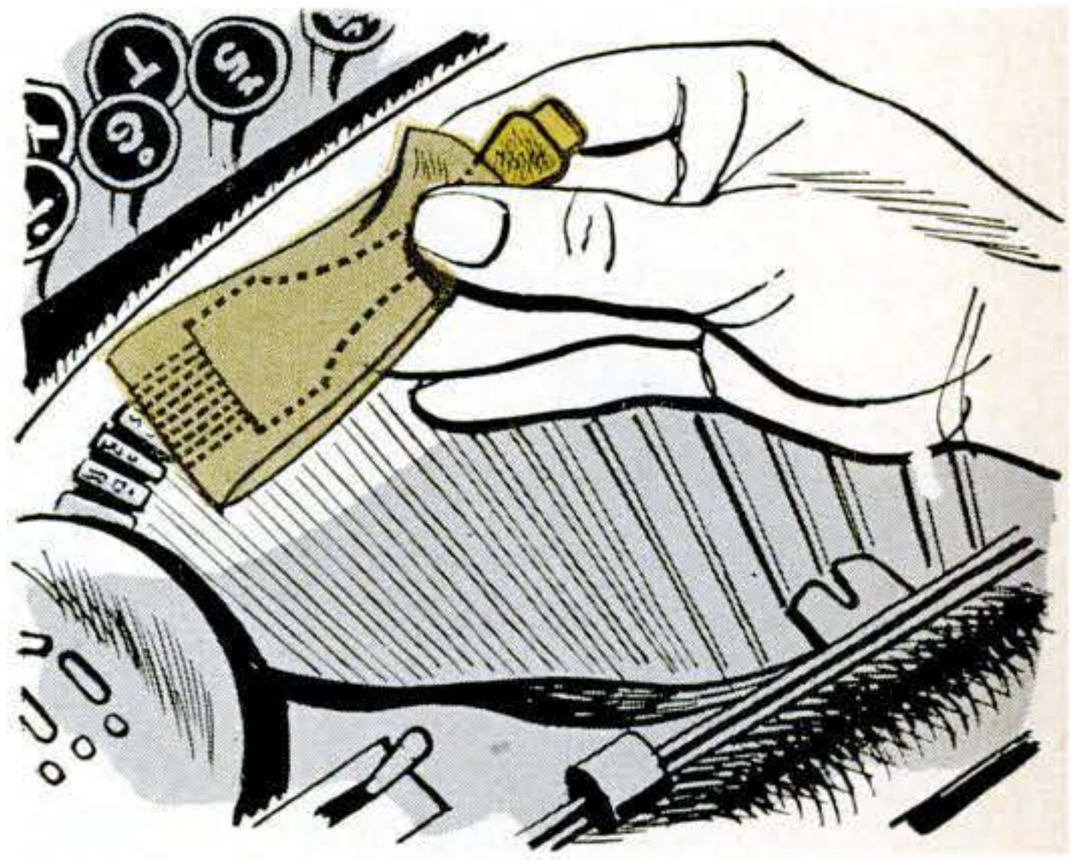
If you store children's socks and stockings in egg cartons, you can tell at a glance how many pairs are clean and ready for use. Cut the cover off the carton first.



If a clothes pole tends to fall from the line or slide along it, here's a remedy: Drill a ¾" hole, as shown above, and insert a clothespin. The pin will grip the line securely.

When applying stitching that must be evenly spaced, baste a cloth tape measure near the edge. Then the stitches can be taken by exact measurement by following the tape.

For efficient protection against moths, drill three holes in your wooden coat hangers and place a moth ball in each hole. Short strips of tape will hold the moth balls in place.



As a final step in cleaning the type of a typewriter—after you've used the brush and cleaning fluid—wrap the brush in a cloth. It'll pick up dirt and absorb the fluid.

Please turn the page for five more suggestions

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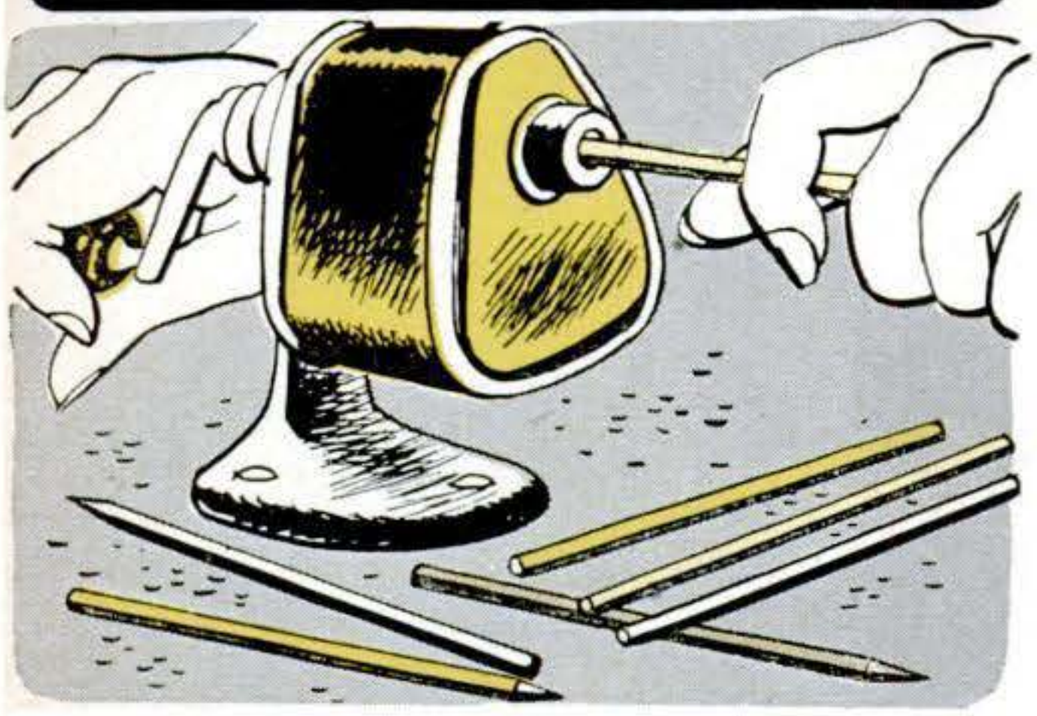
Keeping the Home Shipshape



Meat skewers can be made from scrap lengths of slender dowels. Grind them to a point in a pencil sharpener, but first be sure to brush the graphite out of the sharpener.

When you wind a ball of yarn, use the wrapper of the hank as a core for the ball. Then, if you need more yarn of the same brand and color, you'll have no trouble remembering it.

A little wax melted off an old candle stub will hold the frog in place if the bottom of the vase is uneven or if the stems of the flowers are too long and heavy.

Subtle garlic flavor is easily obtained by rubbing a cut clove on the lid. In cooking, the steamy moisture will drip from the lid and be mixed with the cooking food.

You can turn a tubular metal chair into an out-door dining chair by nailing slit lengths of garden hose to a suitable board. The hose grips the arms and holds the board steady.

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Mechanics and Handicraft

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Dormer Expands an Attic PAGE 202

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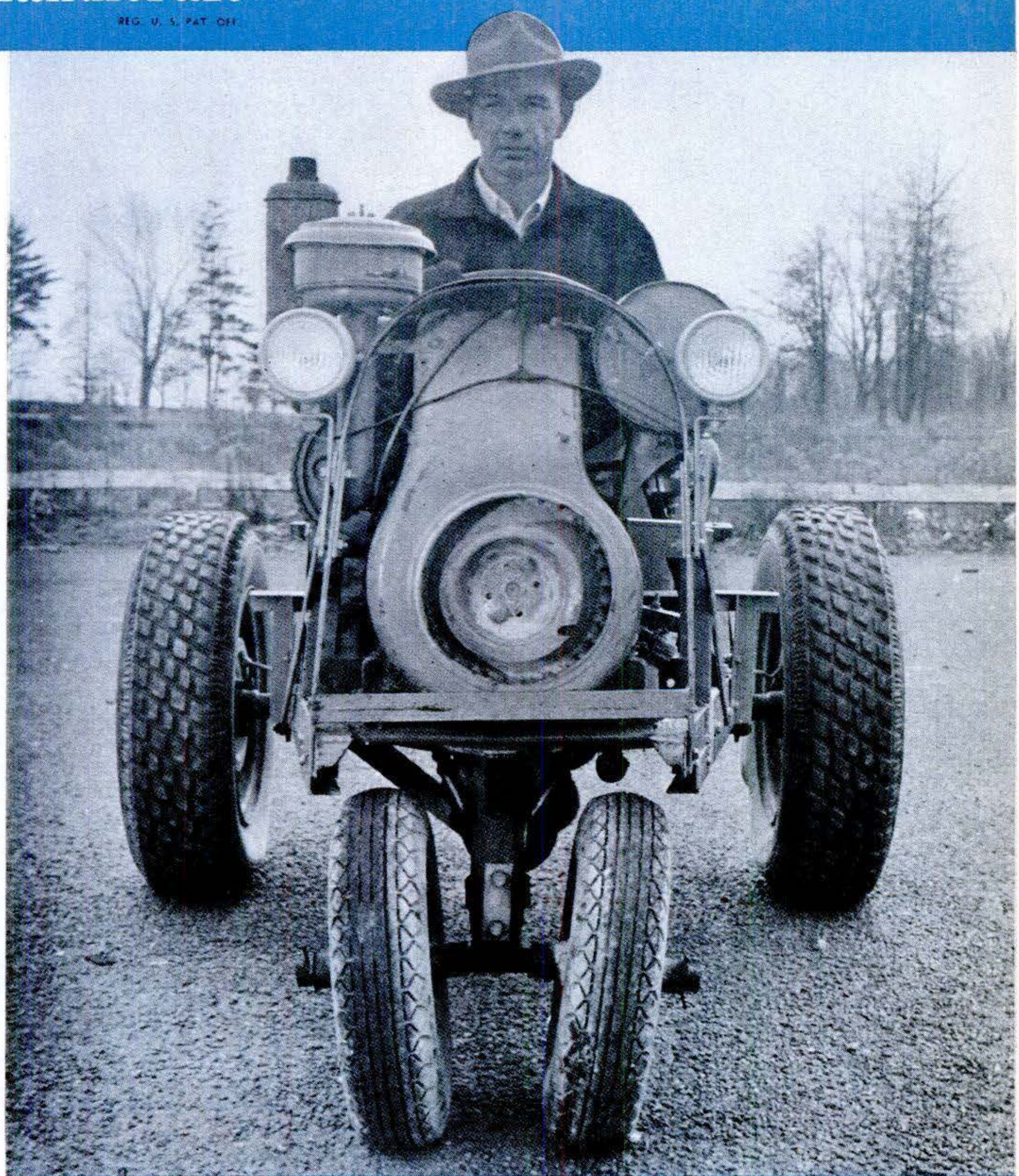
Update That Upright Piano PAGE 235



Baby tractor, homemade for $50, is strong enough to do man-size jobs. Page 209

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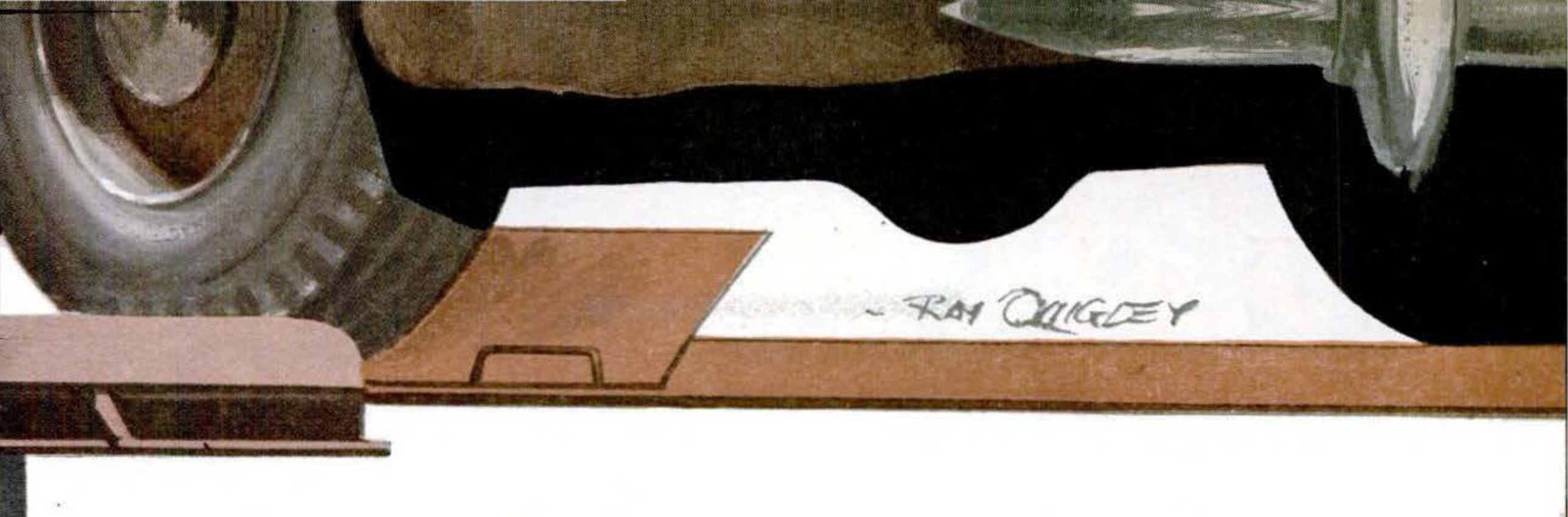
A warm red glow from the heater bathed the underside of the car up near the master brake cylinder



Gus and the Bewitched Brakes

A heat treatment teaches Mr. Pennypincher that you can't be tight when it comes to brakes.

By Martin Bunn

SERGEANT Jerry Corcoran sat on his motorcycle parked just off the hilly main highway from the north where it crosses what we townspeople call "the outer road." He had just about decided it was time to go to a call box up the hill and make his afternoon report to the state police barracks.

An old-model sedan flashed by at a brisk clip, sped through the intersection, and rolled on down the hill. Jerry wheeled out after it. When he caught up with it at the bottom of the hill, he pushed the siren button, motioned to the driver to pull over, and then did a double-take. The driver was old pinchpenny Silas Barnstable, our town's champion tightwad.

Old Silas never so much as turned his head. He just gripped the wheel grimly and sped on. Jerry sounded his siren again. Gradually the car slowed to a stop.

"In a hurry to get some place?" Jerry asked as he strolled back to the car after parking his motorcycle.

Silas was practically half out of the driver's door, frantically explaining. "Honest, Officer, it really wasn't my fault. My brakes failed. Tried to stop, but couldn't. Couldn't slow down 'til I could coast to a stop."

"How come your brakes suddenly went bad?" questioned Jerry. "Had any trouble before this?"

"Not before today," Silas replied. "Been up visitin' folks on the Ridge. When I started the trek home, I began to notice everytime I came down one of those hills my brakes got a little soft. Finally, on this hill here I pushed the pedal smackdab down to the floor and still nothing happened."

"No brakes, eh," Jerry remarked as he motioned to Barnstable to move over and then slid in behind the wheel himself. "We'll soon see."

The sergeant tried the brake pedal. There seemed to be plenty of cushion and resistance to the push of his foot. Then he stepped on the starter button, shifted, and pulled out onto the highway. When the car was hitting 30, he stepped on the brake. The old sedan eased to a perfect stop.

"*So*, no brakes is it?" he mused as he turned the car around and headed back to where his motorcycle was parked.

Jerry got out of the car and started to reach for the leather case where he kept his summons tags. "Don't give me a ticket, Officer," Silas bleated. "Those brakes must be bewitched. They wouldn't work for me."

At this point, a third voice broke into the conversation.

"Having trouble with this ornery citizen?" It was Gus Wilson, and, as Corcoran looked up, he noticed that Gus's car was parked a short distance behind Silas's.

"Happened to be driving down the road, on my way to the lake to work on my boat. When I saw you here, I wondered if you needed any help running this renegade in," Gus added with a grin.

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"Mr. Wilson, you'll vouch for me, won't you?" Silas pleaded. "Tell Sergeant Corcoran I'm no law breaker. Never had a ticket in my life."

"What seems to be the trouble, Jerry?" Gus asked when the whining Barnstable had subsided.

"Well, I can hang at least three counts on this bird without even trying," Jerry replied as he began counting them off on his fingers. "Exceeding the speed limit, disregarding a caution signal, and failing to stop when ordered."

"But it wasn't my fault, Mr. Wilson," broke in Barnstable. "My brakes went bad, and I couldn't even slow down, much less stop."

"His brakes are as good as anyone's," Jerry countered, as he started to write out the ticket. "Gave me the same cock-and-bull story, but I tried his brakes and they worked all right for me." Then, turning to Silas, he said, "Let me see your license, Mr. Barnstable."

"But it *was* my brakes," Silas repeated as he dug into his battered wallet.

"Maybe you *are* being a little hard on Silas, Jerry," Gus put in. "Could be that there is something wrong with his brakes. After all, a man's innocent until proven guilty." For some reason or other, there was something about the old skinflint that had always softened Gus.

Jerry Makes a Proposition

For a moment, Jerry just looked at Silas. Then, tucking his pencil into the top of his black boot, he said, "Okay, you don't deserve it, but I'll tell you what I'll do. I'll let Gus check your brakes back at his garage. If he can't find anything wrong with them, I finish writing out this ticket. If he does find something wrong with them, you're going to pay him to fix them and I'll tear up the ticket. But there'll be no haggling over Gus's price, mind you."

"Humph, it's a hold-up," Silas grunted. "Blackmail. Downright collusion and coercion, that's what it is. I'll . . . " He stopped short when he saw the trooper's hand reach for his pencil. Then he added, "I'll do it."

It was quite a procession that pulled up to the Model Garage a few minutes later. Sergeant Corcoran led the way, then came old Barnstable driving Gus's car, and bringing up the rear was Gus in Barnstable's sedan. Jerry and Barnstable parked outside, while Gus drove Barnstable's old car into the repair shop. Stan Hicks looked up from a valve job he was working on just in time to see Jerry Corcoran and Barnstable come in through the open door. "Don't tell me the old money-grubber's in trouble with the law, I hope," he said to Jerry in half a whisper.

They'd Just Been Checked

As Gus pulled his gray coveralls on over his street clothes, he asked Silas to outline his troubles. When Silas had finished, Gus asked, "Have you had your brakes checked lately? From what you say, it sounds like you may either be low on brake fluid or your brake system has a little air in it and needs bleeding."

"Well you're wrong there," Barnstable grinned cockily. "Just had 'em checked not four days ago down in the city. The man put in fluid too. And he didn't soak me, either," he added, waggling his finger at Gus.

Ignoring Barnstable, Gus set about making a thorough step-by-step check of the car's brakes. He started with the master brake cylinder and a check of the brake-fluid level, and ended, the car on the grease rack, by inspecting the hydraulic lines and bleeding the system at each wheel.

No Leaks and No Air

When he finally emerged from under the raised car he was shaking his head. "That's odd," he thought as he wiped his hands on a scrap of waste. "Plenty of fluid, no visible leaks, and no evidence of air in the lines. Yet, Silas claims his brakes went bad, and, I must admit, they did get kind of soft on the drive over here."

Things weren't looking too good for Barnstable as Gus finally spoke: "It's just a hunch, but there's just one more test I'd like to try." With that he disappeared into the garage office.

When he came back, he was carrying the old reliable reflecting electric heater that

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Joe often used during the winter to help keep the office warm. Gathering up a long extension cord from his repair bench as he passed, Gus then rigged the heater on top of a short ladder that he placed under the raised chassis of the car. When he plugged in the extension cord, a warm red glow bathed the underside of the car.

Freezing Isn't the Answer

Gus had an attentive, though puzzled, audience. Jerry sat watching from a perch on one corner of the workshop bench. Silas Barnstable, standing to one side, looked for all the world like a bantam rooster as he stretched his neck and cocked his head to peer up under his car. Stan just stood there, fiddling with a thickness gauge. He was used to Gus's one-man shows.

"What in blazes you doin' that for?" piped Barnstable, breaking the silence. "Nothin' can be froze up this time of the year."

"Nope, nothin' froze up," agreed Gus. "But unless I miss my guess, the heat from that heater is going to help us find what's back of your on-again, off-again brakes. I got a hunch that it's been heat, and your blamed penny-pinching, that got you in trouble."

Gus let the underside of the car bake for a few more minutes. Then he removed the heater and ladder and told Stan to lower the rack. As the car touched the floor, he turned to Jerry. "Now try those brakes."

Jerry followed instructions. His foot went almost to the floorboards when he pushed the pedal. As though he hadn't believed what he saw and felt, he tried the brake pedal several times more. "Well, I'll be . . ." he said as he pulled his tall frame out of the car. "How can that be?"

Gus pointed an accusing thumb at old Silas. "Unfortunately, Barnstable here hasn't learned that you seldom get more than you pay for. Sure, he got a bargain from those sharpies down in the city—some cheap low-grade brake fluid. But there's no great harm done. We'll flush it out and fill her up again with some good fluid."

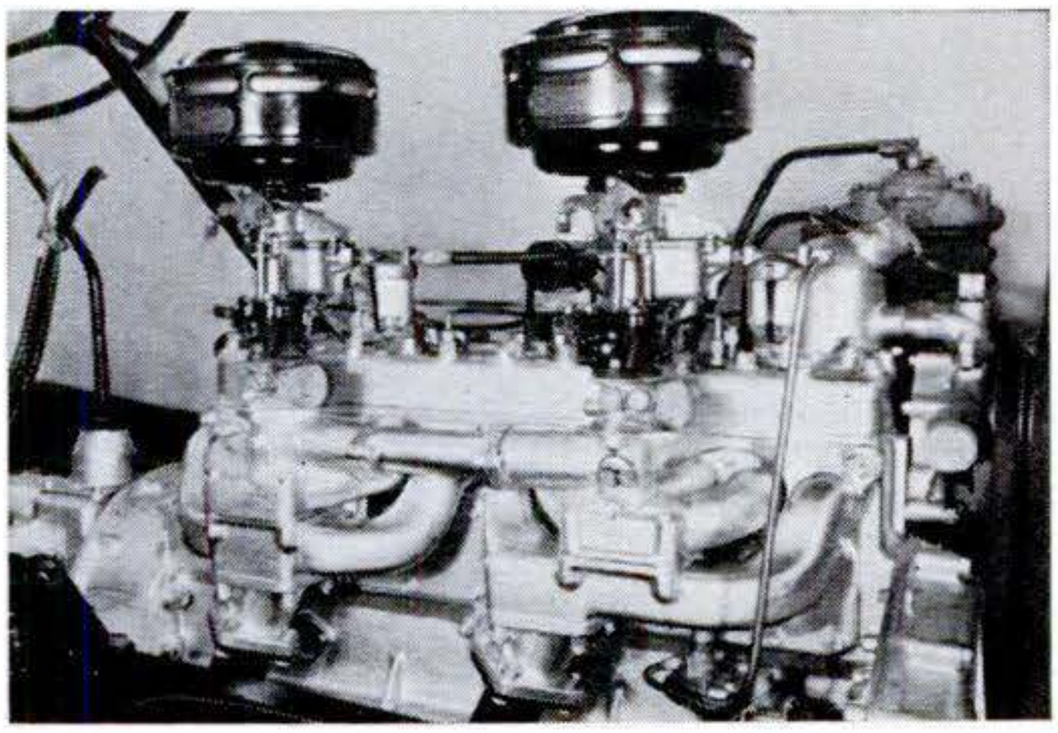
"Now you look here, Gus Wilson," exploded Barnstable. "If you think you're going to hoodwink me by selling me some fancy brake juice, you're . . ."

Brake Fluid on the Hot Plate

"Easy, Silas. Remember you're dealing with Mr. Corcoran here—and a ticket."

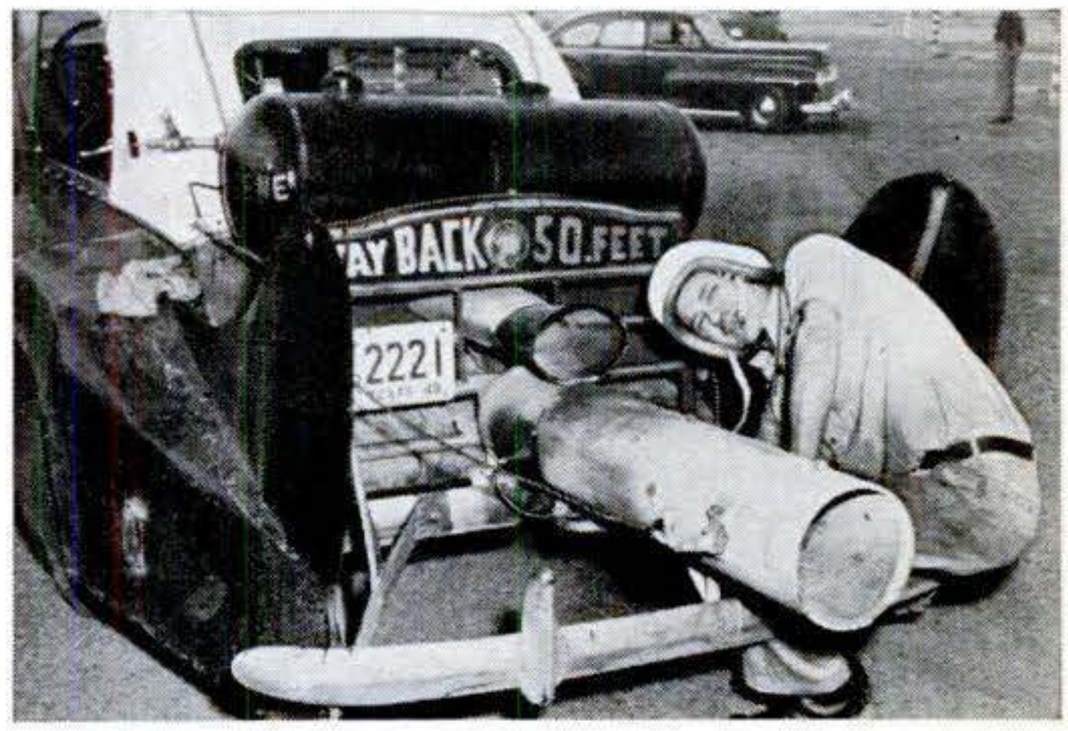
As Gus talked, he picked up the Mason jar that contained the small amount of fluid he had bled from the brakes in checking them and poured it into a can he had carefully cleaned. He then placed the can on a small electric hot plate at the rear of his bench. It was the hot plate that he,

New Engine for Dodge Trucks



TWIN advantages of high-power output and low-operating cost are claimed as a result of several twin features in the engine above, designed for Dodge's new Y and YA model four-ton trucks. The engine, developing 330 pound-feet torque, has twin carburetors, twin manifolds, and a twin exhaust system. The new six-cylinder power plant delivers 154 hp., has a 6.5 to 1 compression ratio, and a displacement of 377 cubic inches.

Homemade Jet Propels Auto



JOHN MITCHELL, an employe of Chance Vought Aircraft, Dallas, Texas, takes his job home. But instead of building fast jet fighters, he has converted a 1934 Packard sedan into a jetmobile, shown above. It has two jet exhaust pipes because Mitchell is experimenting with different versions of the homemade turbojet engines that have sped the novel car at 115 m.p.h. Using kerosene or fuel oil, he has gotten 31 miles to a gallon.

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Joe, and Stan normally used for brewing up their midmorning and midafternoon coffee.

"Now watch," Gus said as he flicked the switch. In no time at all, the fluid was beginning to bubble to a boil. "Low boiling point," he explained as he turned off the hot plate. "And that's one thing any decent brake fluid shouldn't have. There's been a lot of low-grade brake fluids on the market lately, and most of 'em are just out-and-out frauds. They're a concoction of who-knows-what liquids that seem to work all right for ordinary driving. Sure they sell for a price, but when you need your brakes most, they don't work. That's just what you got for your bargain, Silas."

Silas Boils Easily

Judging from the crimson flush on old Barnstable's face it was quite evident that Silas, like his low-cost brake fluid, was about to reach his own low-boiling point. "Thieves, robbers," he all but howled. "They'll pay for this."

"Now don't go blowing a gasket," Gus put in. "Just be thankful you discovered it before you had an accident that might have killed someone. Then you'd have had no alibi. When Jerry or another officer got there and tested your brakes, they'd have found them okay."

"But why?" Jerry asked.

"It's mostly a matter of heat. It takes about 160 horsepower to stop the average car going 60 miles an hour and that develops a heap of heat in the brakes and brake fluid. When you ride those brakes a lot in hilly country, or in heavy city traffic, the hydraulic fluid gets plenty hot. With a good high-boiling-point brake fluid—like the kinds okayed by the Society of Automotive Engineers—heat causes no trouble. But with a cheap fluid, made up of low-boiling liquids, it vaporizes and forms vapor pockets in the brake system. When that happens, the brakes just won't work, just as they wouldn't work when I heated up the master brake cylinder by putting that heater close to it. Instead of pushing fluid against the brake pistons to operate the shoes, your foot pedal pushes against vapor."

The Vapor Vanishes

"But how come they worked all right a few minutes later?" Jerry asked.

"When the vapor cools," Gus explained, "it condenses back to a liquid and you have a normal working braking system. That is, until you start tramping on the brake pedal again and generate more heat."

"Well, which is it," Jerry asked Barnstable. "A new fill of approved brake fluid, or that ticket I've got half filled out?"

"How much will that new fluid cost me?" asked Silas, his eye still peeled for a bargain.

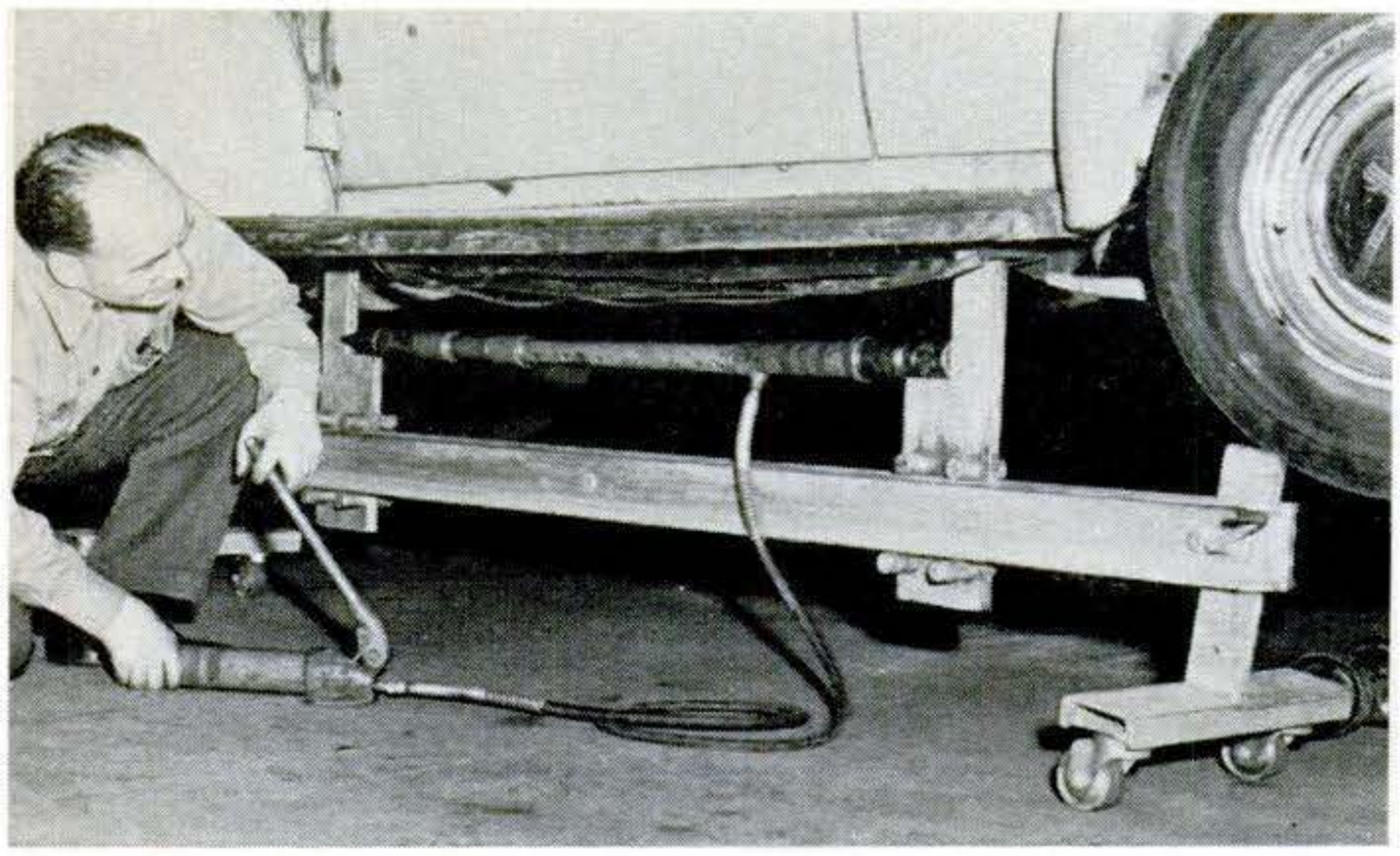
"Only a few cents more than the stuff those cut-rate gyps sold you," Gus told him.

"It's a bargain. And mind you, no funny business on extras either."

"That chiseler," Stan muttered after Jerry Corcoran and Silas had left. "I'll bet he's already got a bargain set up for his own funeral—a nice used grave in some abandoned cemetery."

"Oh, don't be too hard on old Silas," Gus philosophized. "There are a lot of Silases in the world who'll settle cheap for a bigger deal than brake fluids and tires—if the price is right. They've just got a mixed-up sense of values, I guess." END

Hydraulic Ram Straightens Damaged Car Frames



WITH two uprights braced against bent members of a car frame, the mechanic at left uses a small, portable pump to extend a hydraulic ram that will exert pressure to straighten them. The bent parts are then heated, and the Rogercraft Frame Press removed only after the metal has cooled. The press, made by the Hayward Implement and Engineering Co., Hayward, Calif., is eight feet long extended, and weighs 175 lb.

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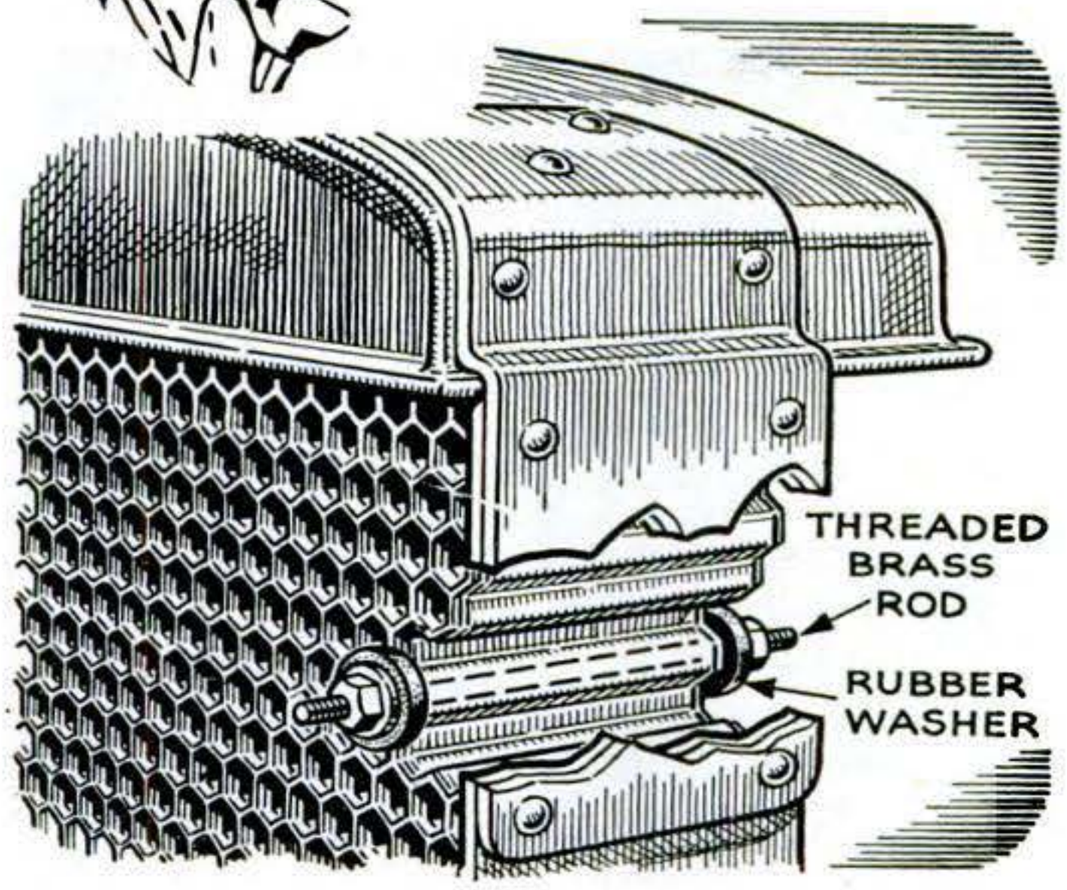
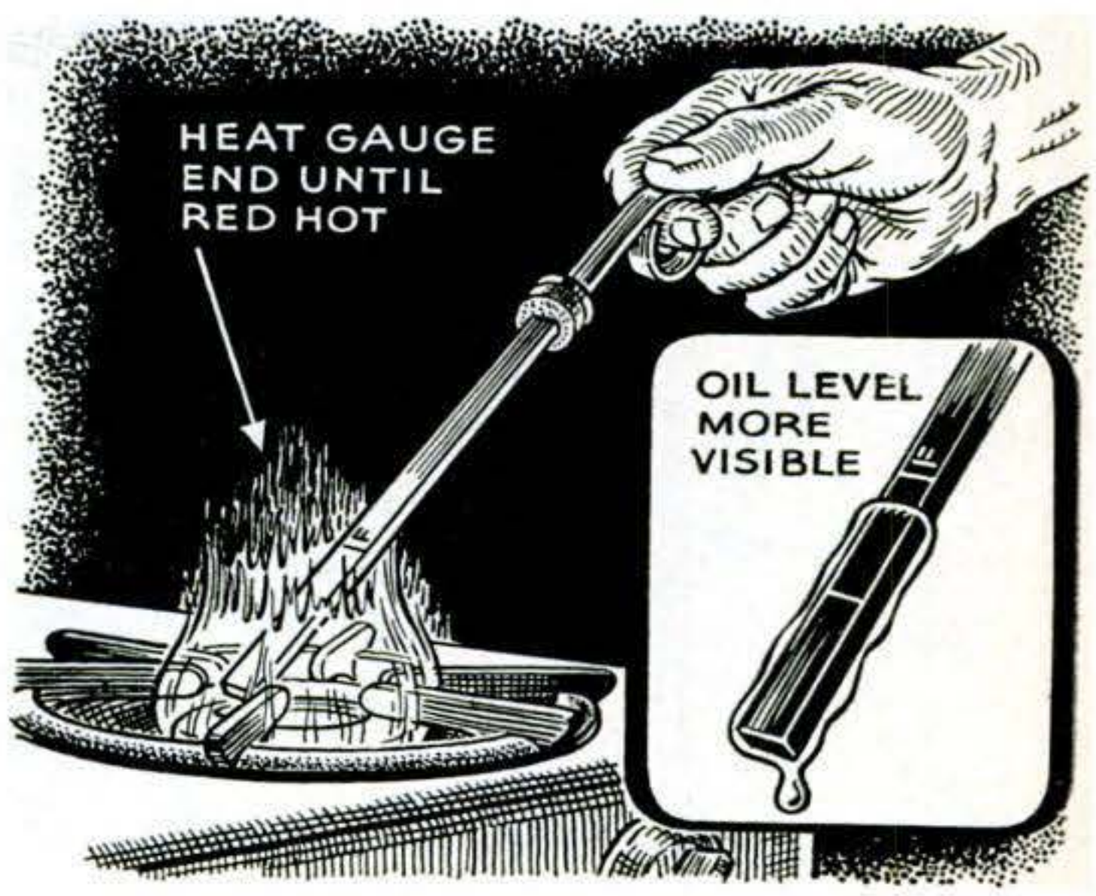
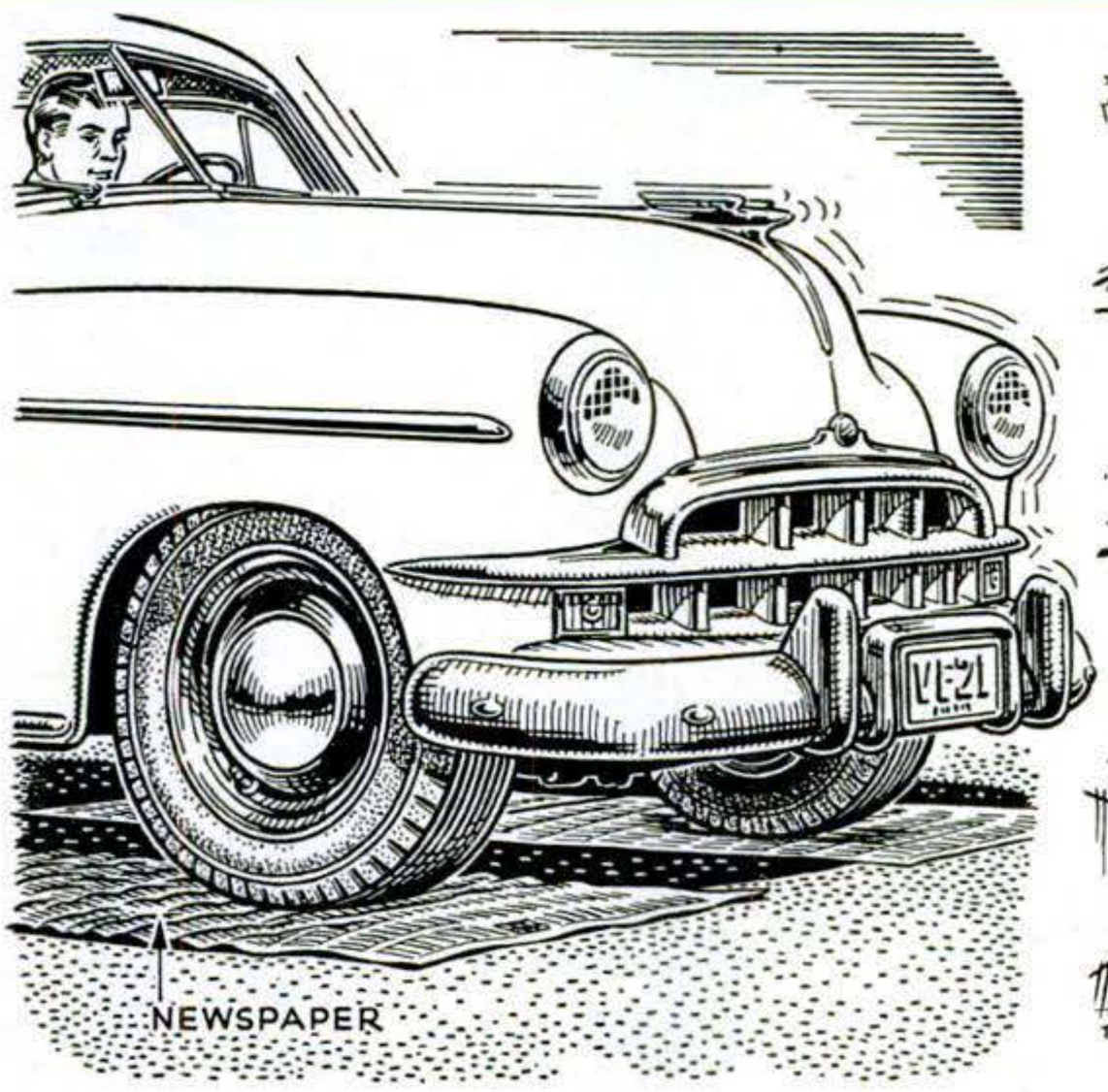
Hints from the Model Garage



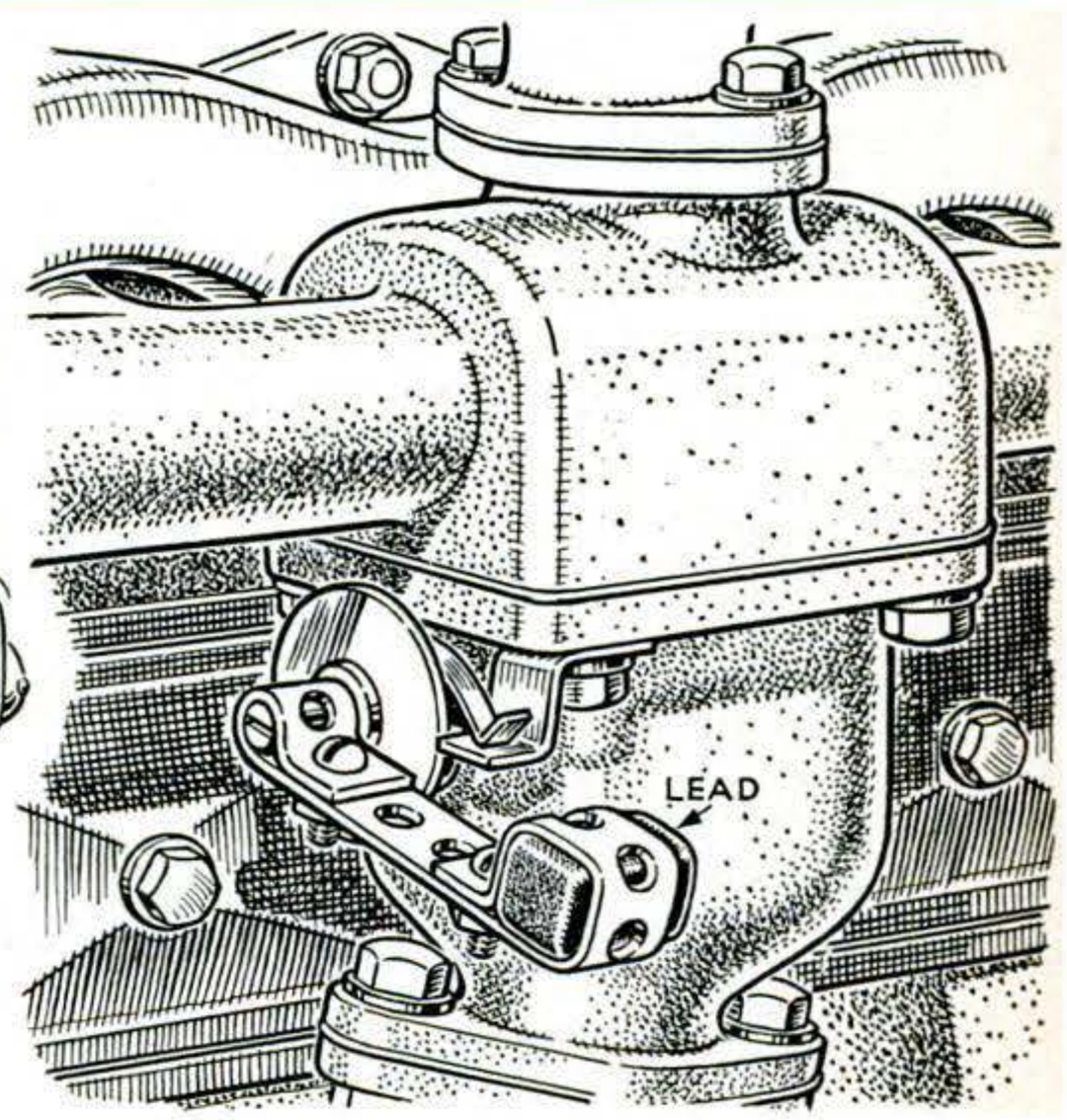
Stopping a Radiator Leak. When a leak developed in one cell of his honeycomb type of radiator, Joseph C. Cappetta, New Haven, Conn., stopped it as shown. The brass pin must be longer than the depth of the cell. The rubber washers seal the leak.



Oil Line Shows Better. To make the oil line more visible on your crankcase dipstick, Edward Wujcik, of Detroit, suggests heating the gauge end red hot in a gas flame and then letting it cool. The heat changes the color of the stick.



Paper Tests Brakes. Not sure which of his front brakes was grabbing, Lewis A. Emswiler, of Etna, Ohio, placed several sheets of newspaper on the garage floor in line with the wheels. Driving on the paper, he applied the brakes. The wheel with the grabbing brake ruffled the paper. It remained smooth under the other.



Homemade Balance Weight. When the balance weight on his manifold heater broke off, Sidney E. Lang, of Bakersfield, Calif., made his own as shown. After bolting a piece of plumber's strap around the control rod, he formed a loop in the other end, adding just enough lead to keep the valve open while the motor was cold.

Turn the page, please, for three more auto hints

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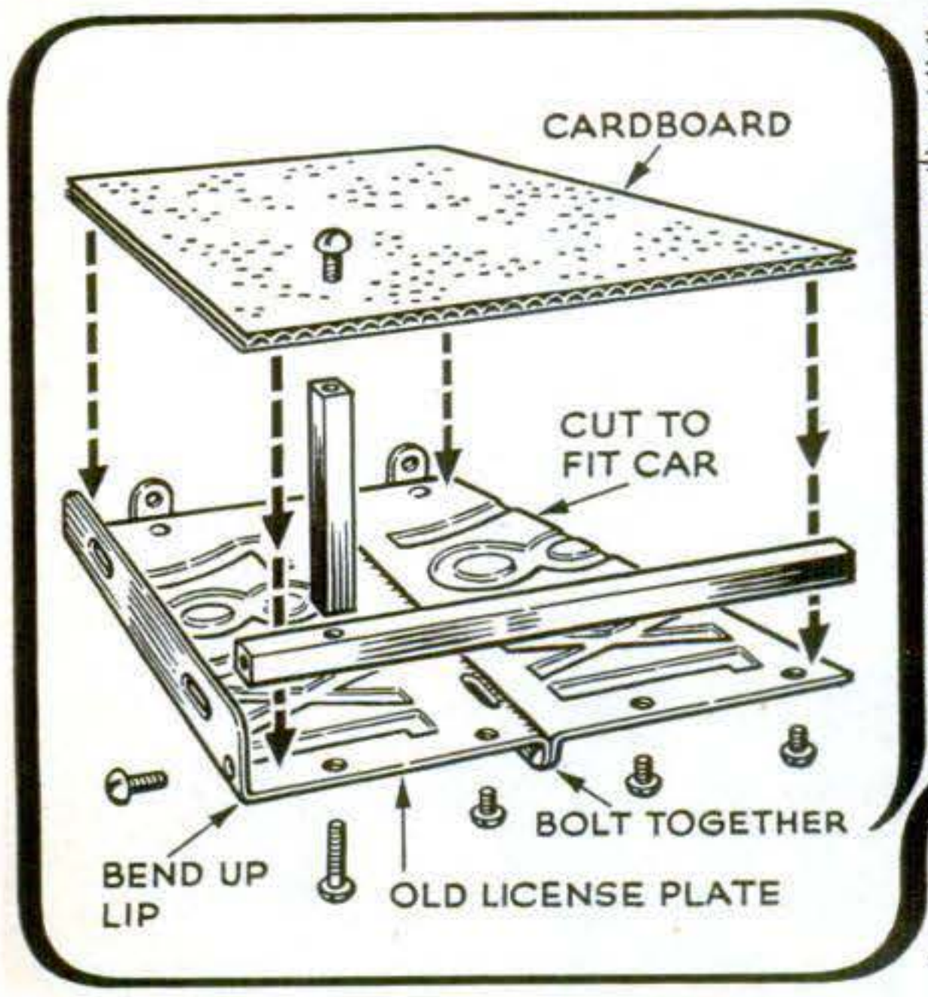
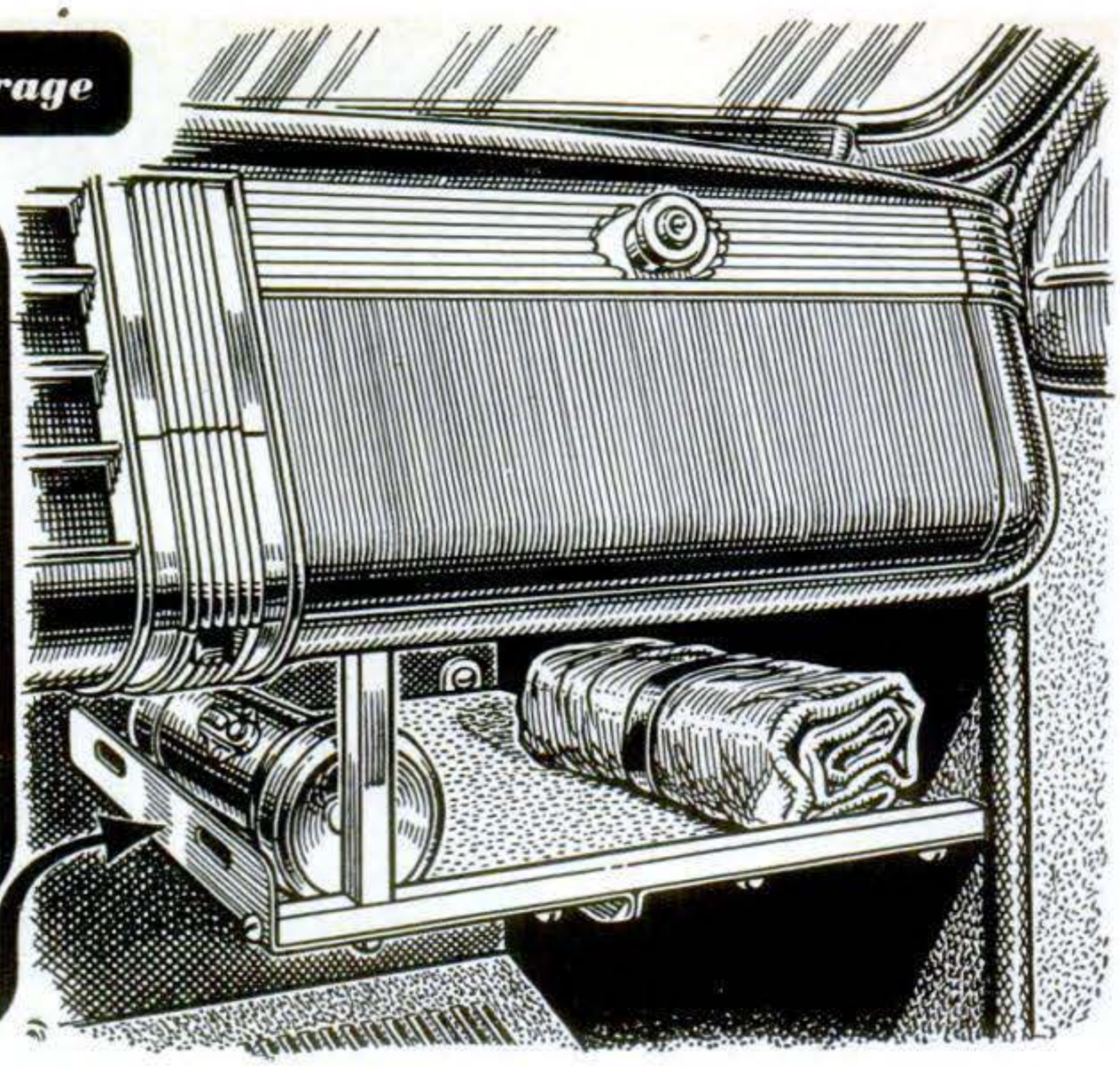
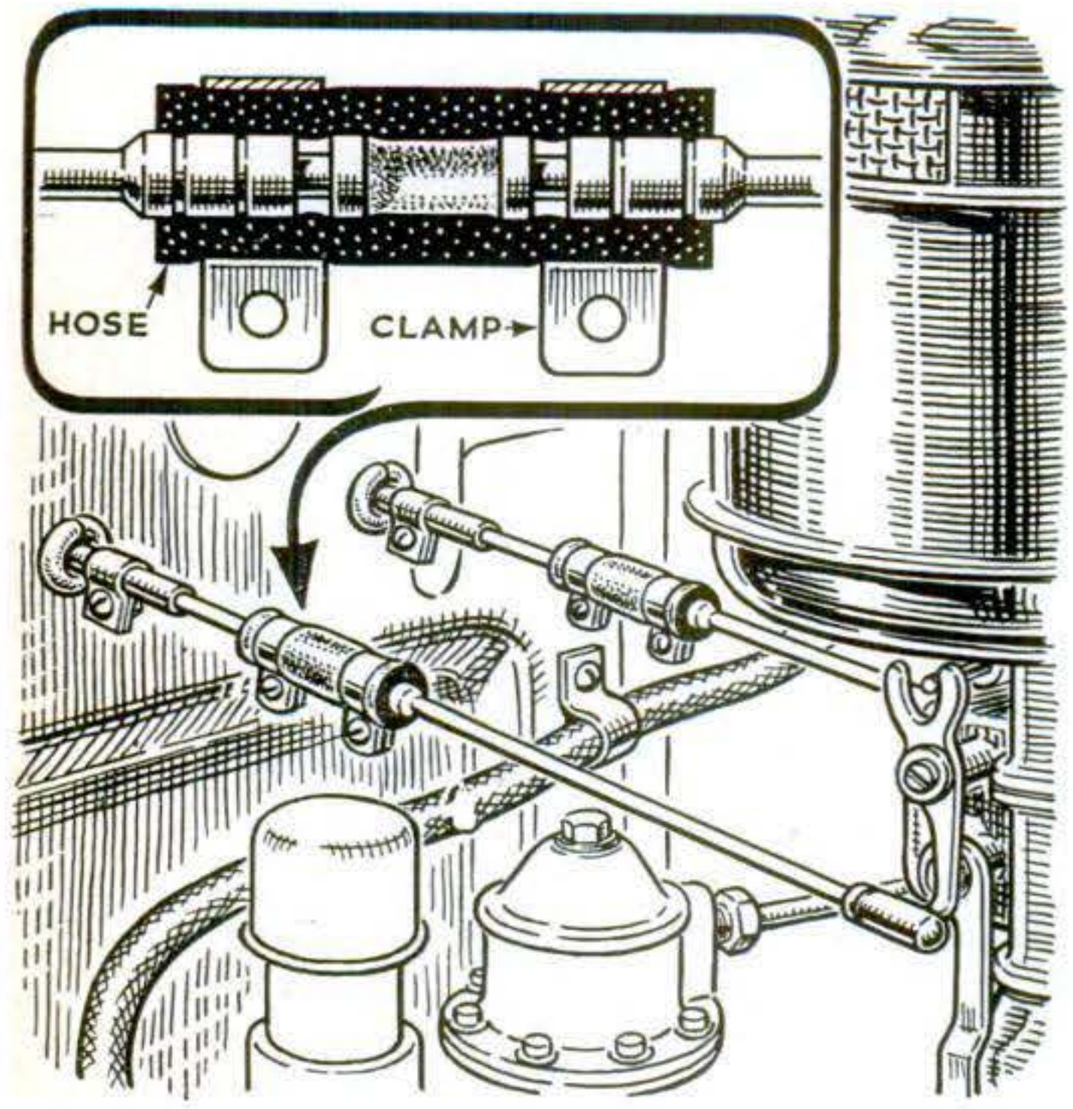
MORE Hints from the Model Garage

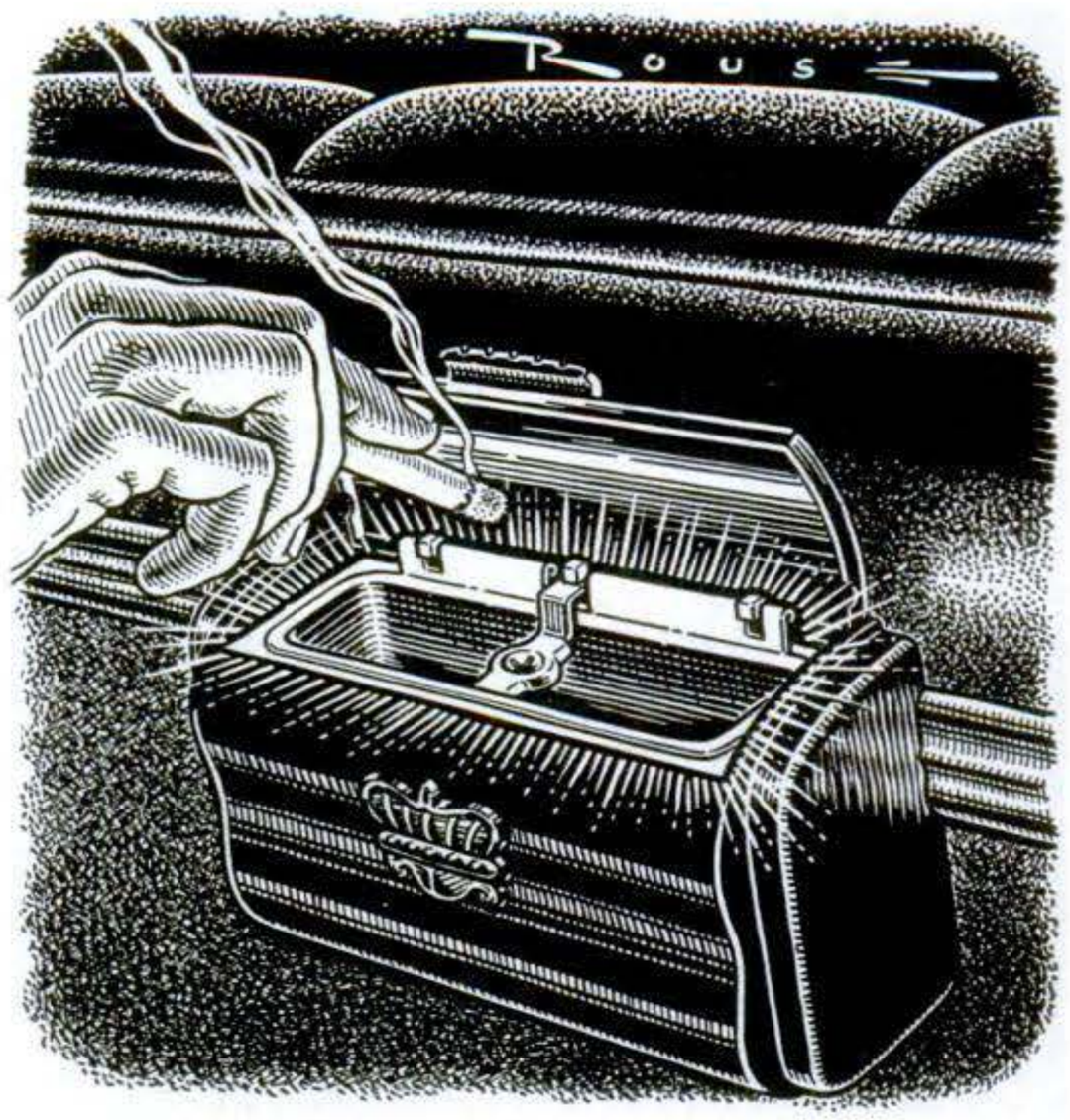




Shelf Under Dash Is Handy. In some of the older cars, you find considerable space in the corner below the dash. A shelf placed there makes a convenient place for carrying small items.

The shelf can be cut to shape from a couple of old license plates bolted together. Bend up one edge to form a retaining lip. Bolt or weld a stiffening piece of metal along the front edge. Fasten the back of the shelf to the fire wall. A support from the edge of the dash will hold up the front corner. Cut a piece of corrugated cardboard to fit snugly in the shelf.





Repairing Ford Controls. In recent years, Fords have had molded rubber links on the hand-throttle and choke-control rods near the carburetor. Age, oil, and heat sometimes cause these to break. As a replacement, E. J. Novak, of Omaha, Nebr., suggests clamping a piece of hose on the rods. Air hose of ¼″ inside diameter is just right.

Ash Tray Glows in Dark. Noting that smokers often missed the ash trays in his car at night, William G. Kendrick, of Cincinnati, Ohio, applied some phosphorescent paint to the upper edges of the trays. After being "charged" during the daytime or by a flashlight held close for a few moments, the paint then glows for several hours.

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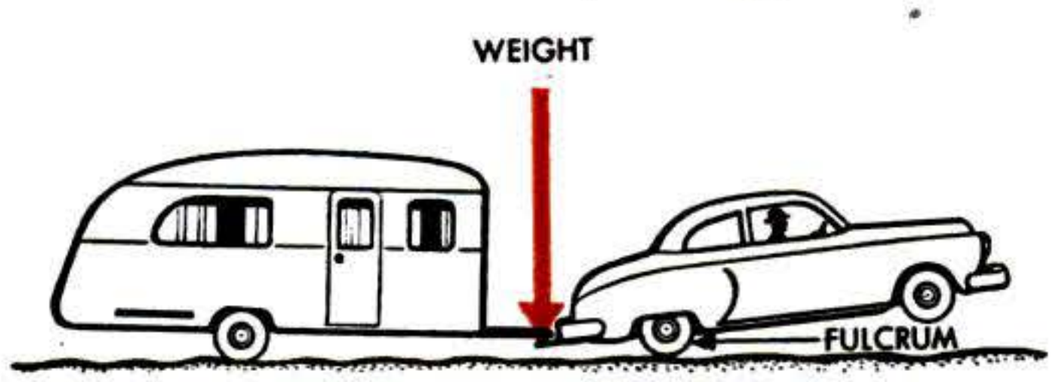
What You Should Know About

Towing a Trailer

By R. P. Stevenson

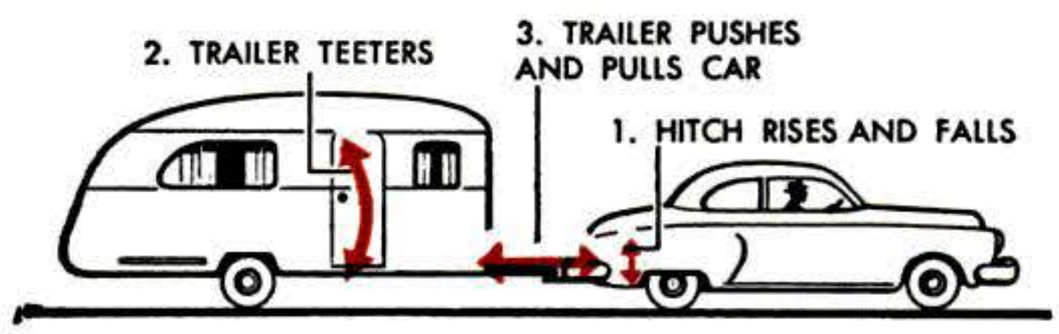
YOUR car was designed and built primarily to haul passengers, not to tow a heavy trailer coach. That it can and will do the towing job too is an extra dividend tossed in your lap. But as the car stands, it's not ready for the job. You must take up where the designers left off.

This would become plain enough if you were to install an ordinary bumper hitch, hook up a fair-sized trailer, and set off without further preparation. Here are some of the undesirable results you might observe:

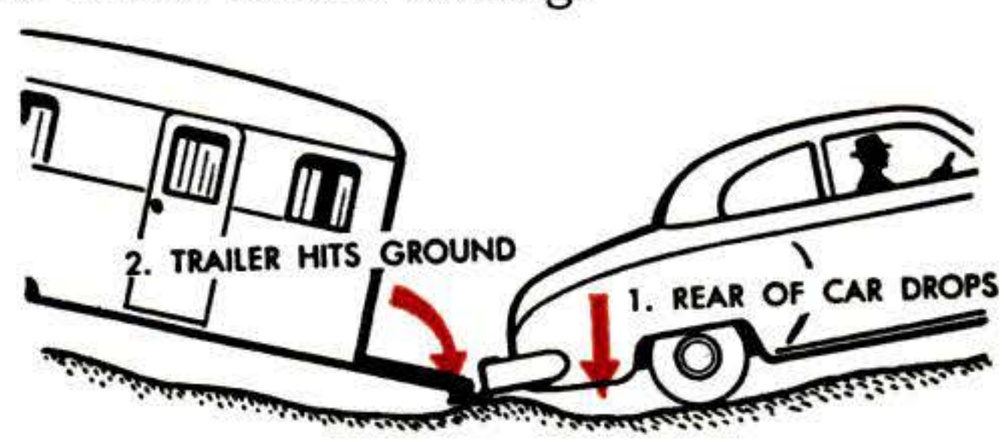


Leverage. Because a trailer imposes a portion of its weight on the end of a car, a cantilever would be set up—with the car's rear axle as the fulcrum. The extra weight could easily load the rear axle beyond the maximum for which it was designed. You might not notice such an overload at once—but you couldn't help seeing that the car's front end tends to rise as the trailer bears down on a bumpy road.

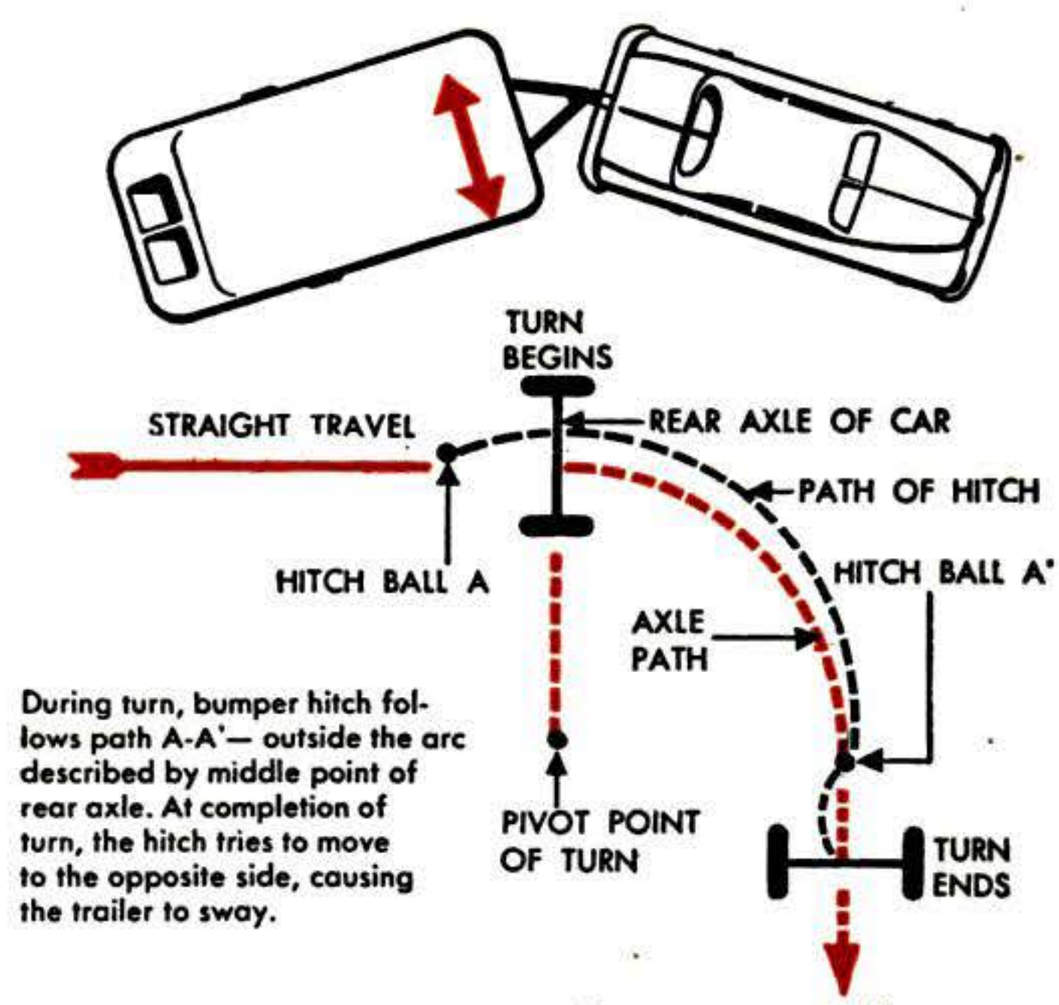
Because of the heavy strain, the car's springs may break, the frame twist, the axles bend, or the hitch snap.



Surge. You can feel this while riding in a tow car. It is a push-pull effect produced by the normal rising and falling of the bumper hitch. As this occurs, the trailer's center of balance shifts back and forth—that is, the trailer teeters endwise. Consequently, the tow bar alternately shoves and pulls back on the hitch ball. The hitch and car frame take a beating.



Nose-diving. This occurs when the rear wheels of the car have just dipped into the valley at the bottom of a steep ramp or service-station apron. The rear bumper sweeps low, causing the trailer nose to strike the pavement. Because of this, you may be unable to haul a trailer across a ditch.



During turn, bumper hitch follows path A-A'— outside the arc described by middle point of rear axle. At completion of turn, the hitch tries to move to the opposite side, causing the trailer to sway.

Sway. On a straightaway, a bumper hitch follows behind the center of the rear axle. As you begin a turn, the hitch swings outward—away from the direction of the turn. Momentarily, the hitch turns the trailer in the *wrong* direction.

Once headed the wrong way, the ➡

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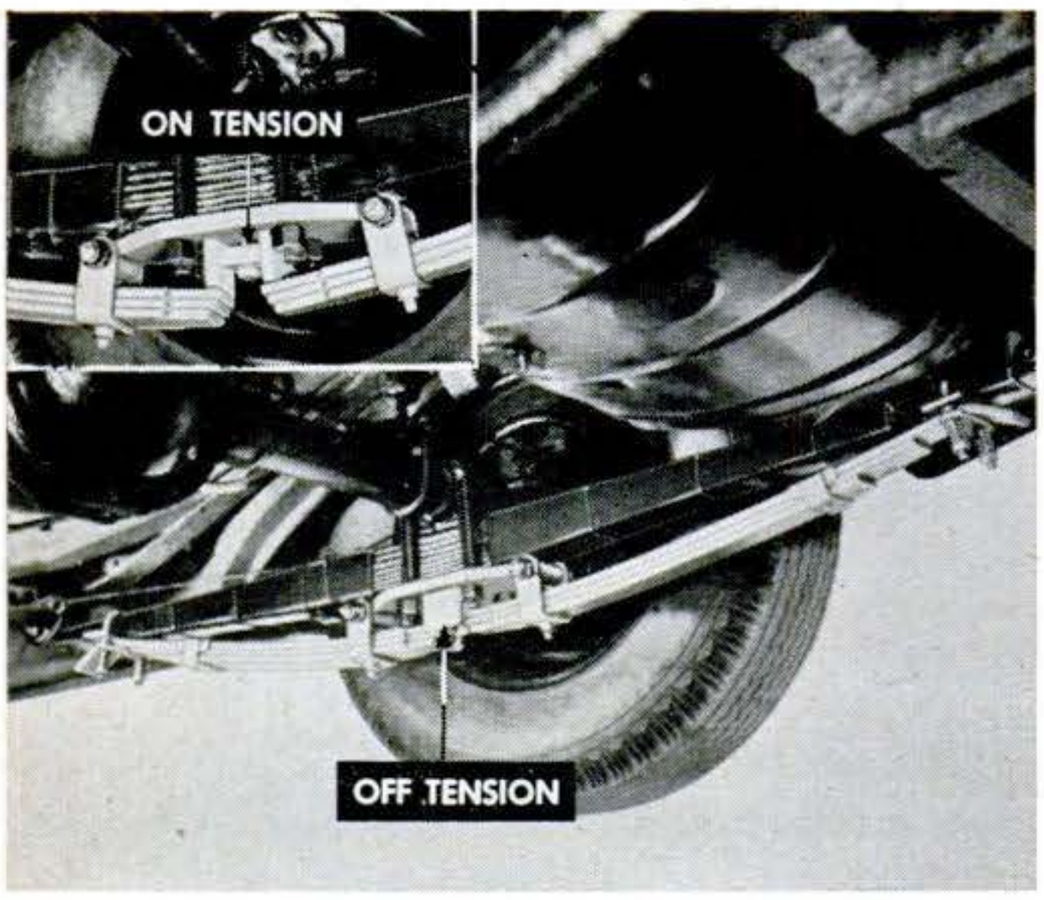
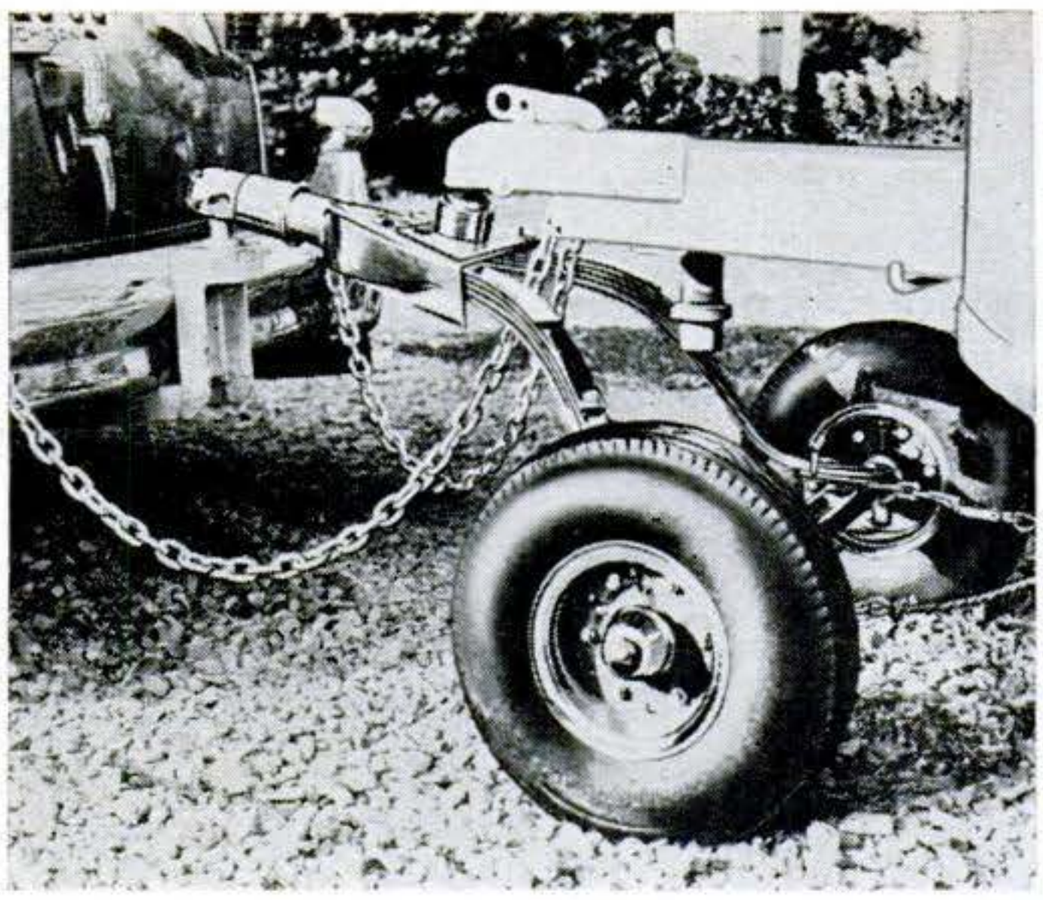


These overload springs don't cause hard riding after trailer is unhitched. Swiveling the H-shaped block removes or applies tension. The makers also offer releasable leaf-spring helpers for cars with coil springs. Another manufacturer sells helpers that adjust to suit the load.

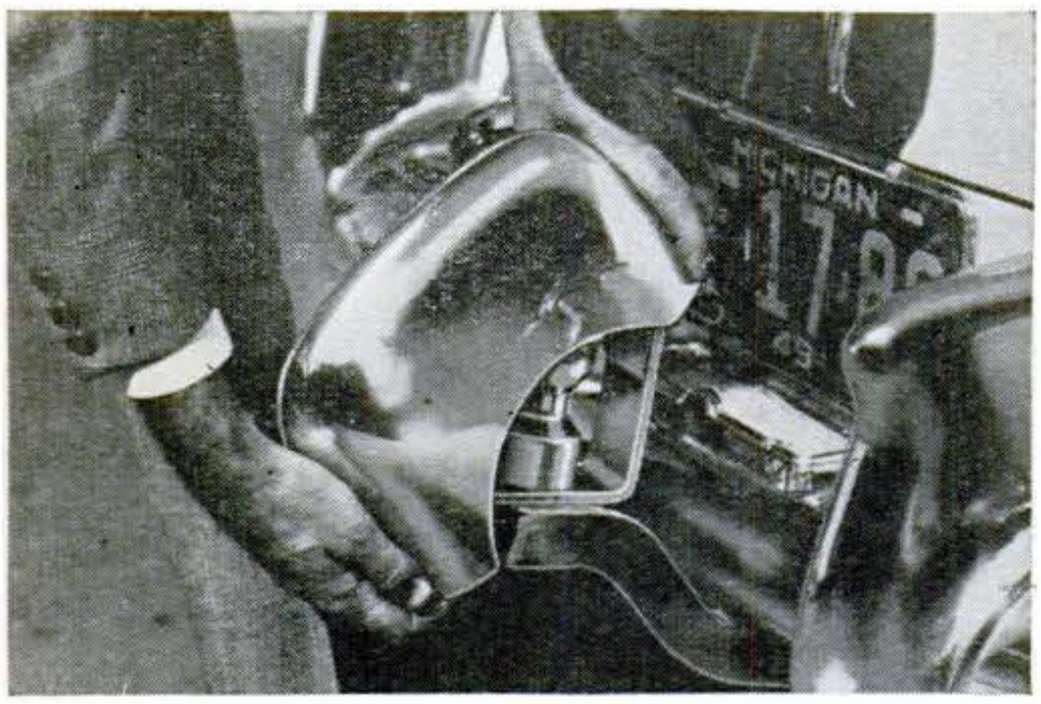


Hitch the dolly to the car, the trailer to the dolly. That's the principle of this and several other dollies. The two hitch balls make the unit more flexible, reducing road shock both in car and trailer. Another type has one or more wheels under the trailer without a second hitch.

heavy trailer resists the pull of the hitch ball, and the tires and car frame take an extra load. When you come out of the turn, the hitch ball tends to swing in the opposite direction. This sets up a whip action, and the trailer begins to sway.

Should you make a sharp turn to avoid a road obstruction, sway can tip the trailer over. If the road is slippery, your unit may jacknife.

What you can do. Because of the forces at work, a sturdy hitch is a must. Hitches are available commercially for most cars, but you can have a special one made to order. Some are bolted or welded only to the rear cross member of the car frame. To spread the load, others have arms extending to the side frame. It is important to keep the hitch from shifting sideways. After the hitch is made, the tow bar should incline up toward the car instead of being left level.



A chrome cover will protect your hitch ball and improve appearance of car. This one is made by John Hill Plating Co., Lansing, Mich.

To counteract leverage effects, some owners use overload, or helper, springs. But you should note that these merely keep the rear of the car from bottoming. They do not remove an overload from the frame, axle, and tires of the car.

A dolly under the trailer will do this. Some dollies are designed to carry all the load, others only part. Overload springs can be combined with the latter. As a rule, some extra load should remain on the car. This improves traction.

A dolly also will lessen surge action by keeping the trailer on a more even keel. Overload springs will forestall nose-diving by preventing the hitch from going so far down. A dolly with a tow bar that's free to rise and fall with the bumper ball will also keep the trailer nose clear.

The possibility of sway is inherent in any bumper hitch. A dolly may help a little but will not prevent it. Your best protection is caution on turns.

Trailerites disagree on whether it's best to use helper springs alone, a dolly alone, or a combination of the two. A good case can be made for or against each method, depending largely on the particular equipment and whether it's installed and adjusted as the manufacturer recommends. If the trailer is small and well balanced, helper springs may get you by. For one of the big jobs, a dolly probably will be a must.

Avoid an overload. Every trailer has a certain hitch-ball weight. This may range

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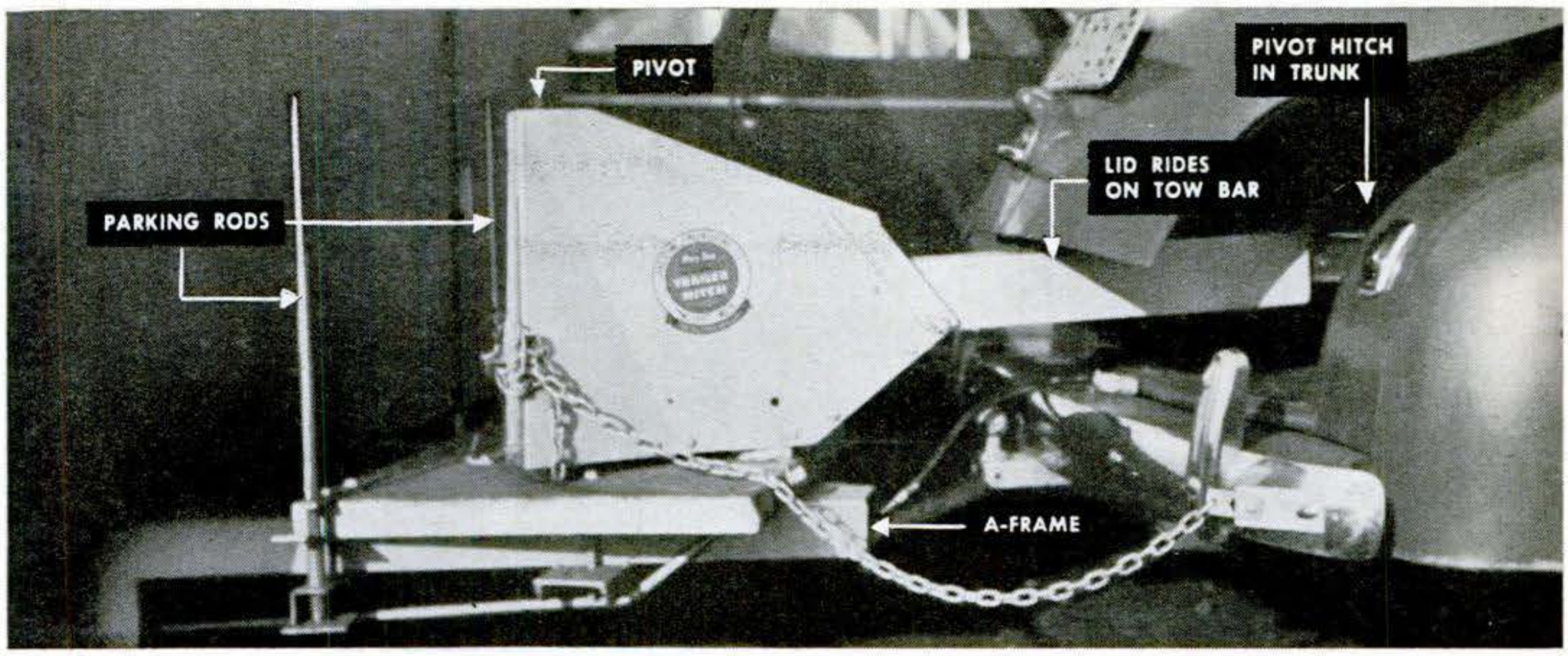


Over-axle hitch now on market uses same principle as the fifth wheel of a trailer truck. Tow bar attaches to a pivoting hitch located in trunk above the car's axle. Entire tow bar also pivots at the trailer. On ordinary, slight road curves, the bar pivots only on hitch ball in trunk, the bar being limited in side movement to about five inches. On greater curves, tug of safety chain causes second pivot at rear to go into action. On straightaways, this is locked by two rollers that sit astride a cam. The maker claims open lid is no disadvantage.

from 200 to about 700 lb., depending on the trailer's size and balance.

At least one car maker (Buick) recommends that the rear-axle load be kept below 500 lb. This is probably a safe maximum in any car. If you are in doubt about the load, haul the trailer to a truck scale. Park the car on the scale and weigh it both with and without the trailer attached, keeping the trailer wheels off the scale. The difference is the rear-axle load. Do this after you have loaded the trailer for traveling. A few extra furnishings up front can produce a sharp increase in the ball weight. Your solution is to distribute the furnishings to keep the hitch weight from climbing.

Rear-tire pressures usually must be increased because of the extra load. Buick recommends 30 lb. at the rear, 24 at the front for its recent models. For more comfortable riding, deflate the tires to normal pressures after unhitching.

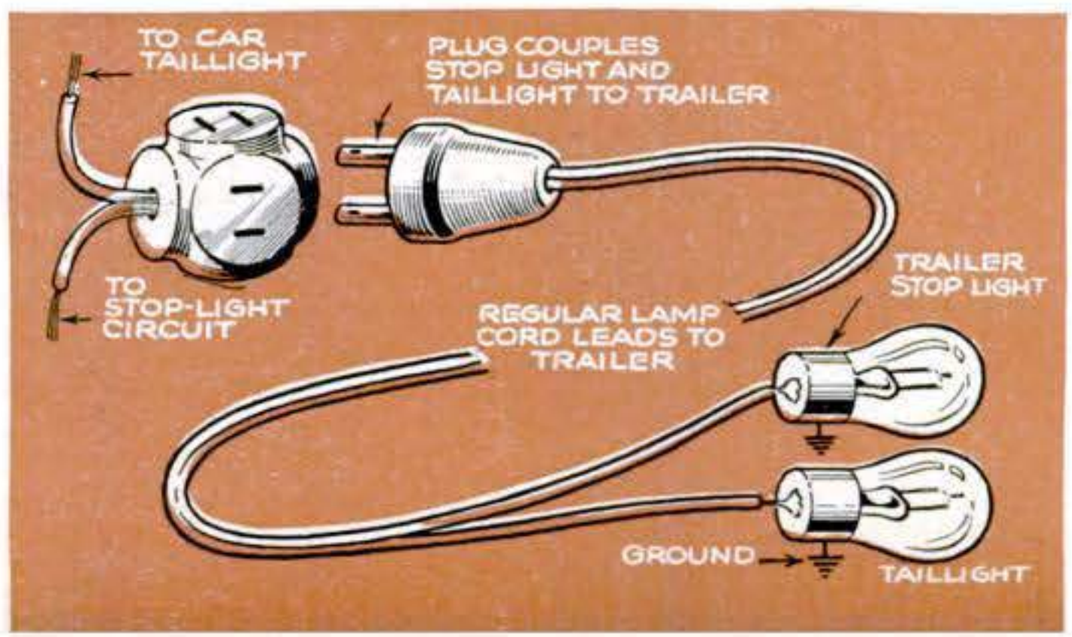
What about a fifth wheel? Trailer men have long realized that a hookup patterned after the big truck trailers would have advantages. Moving the hitch ball up to or ahead of the rear axle would reduce or eliminate many of the bumper-hitch faults. Obviously, this presents difficulties in a passenger car. However, you can buy several outfits that make the hitch under the axle—and at least one that goes over the axle. The latter is shown above.

Is an automatic transmission suitable for trailer towing? That's a question you'll want to know these days. The engineers have wondered too, and have made some test runs. Their answer:

Yes. Uphill, there's no lack of power. Downhill, the transmission can do a good braking job. And on starts, the engineers say, there's a positive advantage, for the oil cushion helps get both car and trailer under way easily and smoothly. END

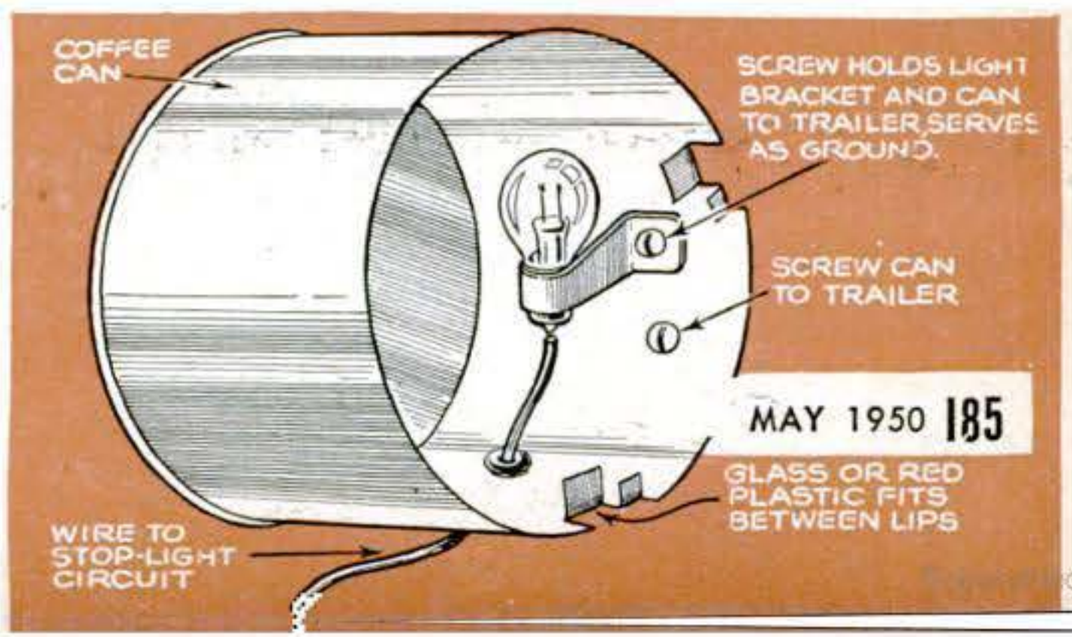
One Plug Connects Two Lights

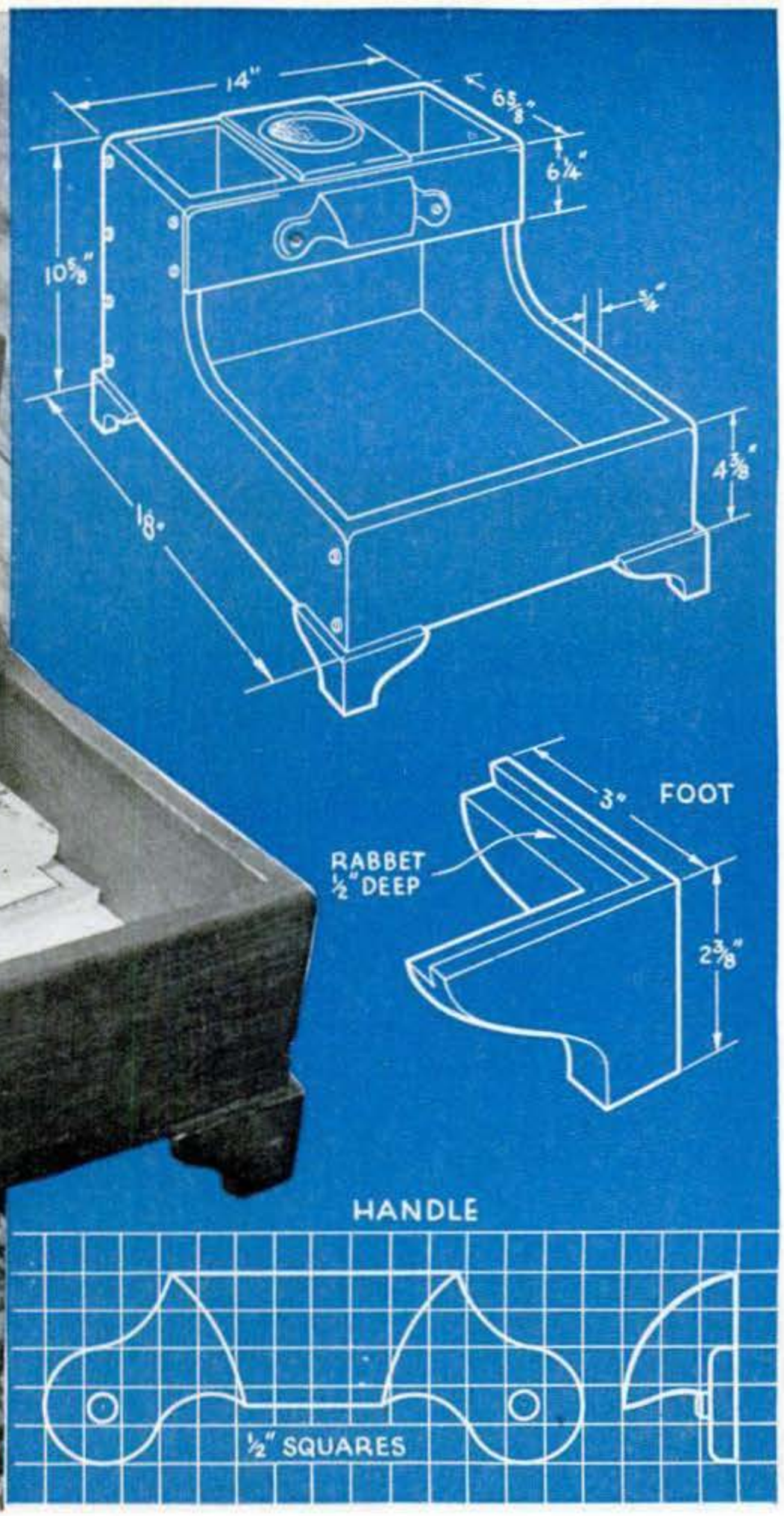
You can use household electrical supplies as below to connect a trailer tail and stop light to the tow car. Mark the plug and socket so you won't reverse the connections. You'll need a ground return if trailer and hitch aren't metal.



Stop Light from Coffee Can

An effective stop light for a trailer can be made as shown here. If you don't use the trailer a lot, you can probably get by without investing in a bulb socket. Just solder the bulb to the can and the hot wire. Use a 21-candlepower bulb.





For Solid Comfort Build This Magazine and Smoking Stand

WITH this stand beside your easy chair, both your smokes and favorite magazines are within an arm's length. It's built of clear white pine, stained and waxed.

You have your choice of joints—rabbet, miter, or butt—held together with dowels and glue. Or, assemble with wood screws set into deeply counterbored holes. Plug the ends of the holes with rounded dowels in imitation of pegs.

The feet are each made of two pieces, rabbeted and mitered as shown. The box-like body rests in the rabbets and can be glued in. The ¼" plywood bottom sits in grooves cut in the four sidepieces.

You can jigsaw the handle to rough shape and then finish it with a rasp and sandpaper. It can be attached with two dowels at the ends and wood screws from inside.

The ash tray can be hammered out of a copper or pewter disk. First dish the center by hammering it over a depression. To flatten the flange, jigsaw a hole in scrap wood the size of the dished part. Place the tray in the hole, leaving the edge protruding. Insert the plug that was sawed out, place the whole works in a vise, and clamp tight. This will hold it so you can hammer the rim.—*L. T. Cronk, Valhalla, N.Y.*

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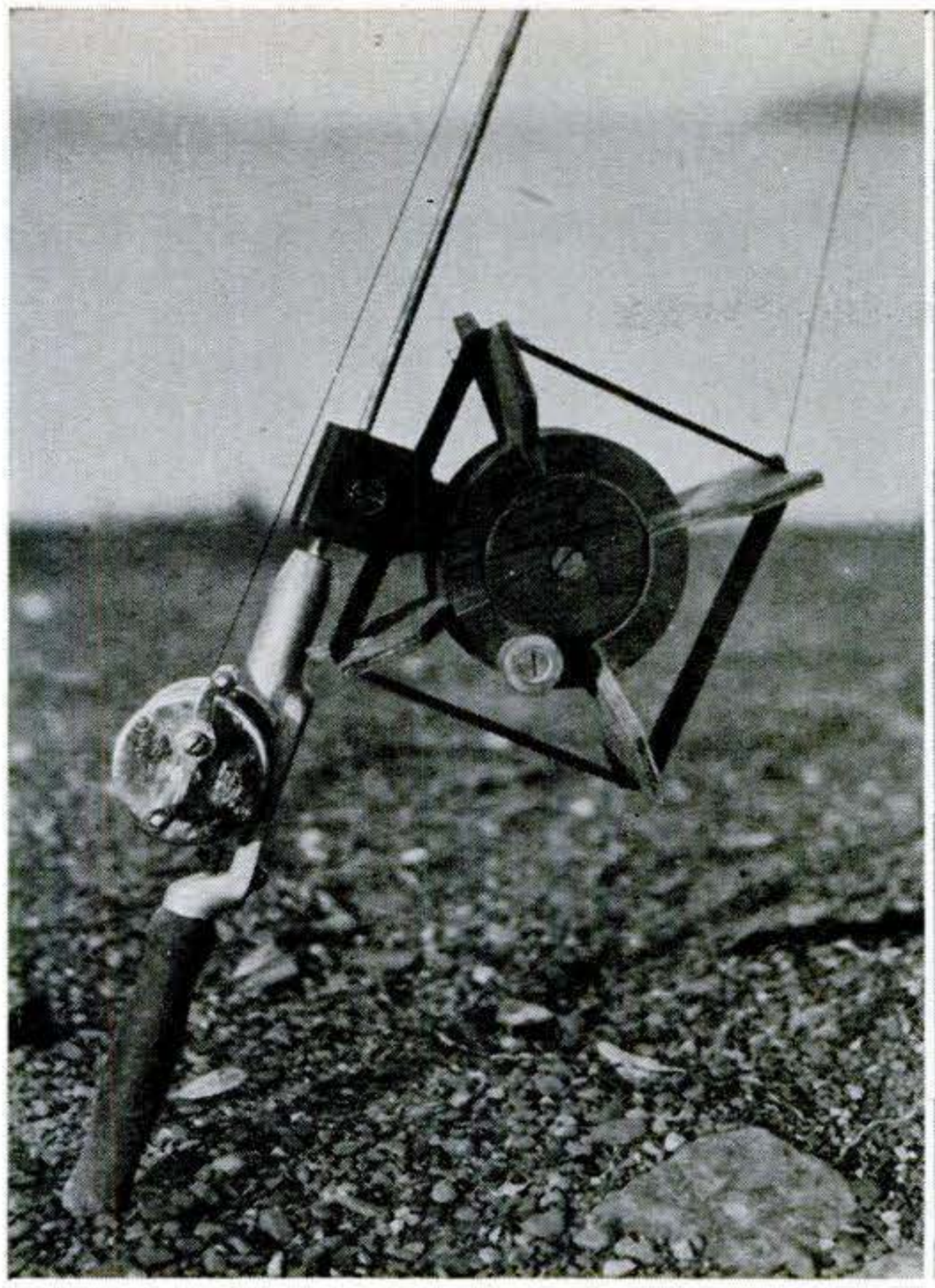
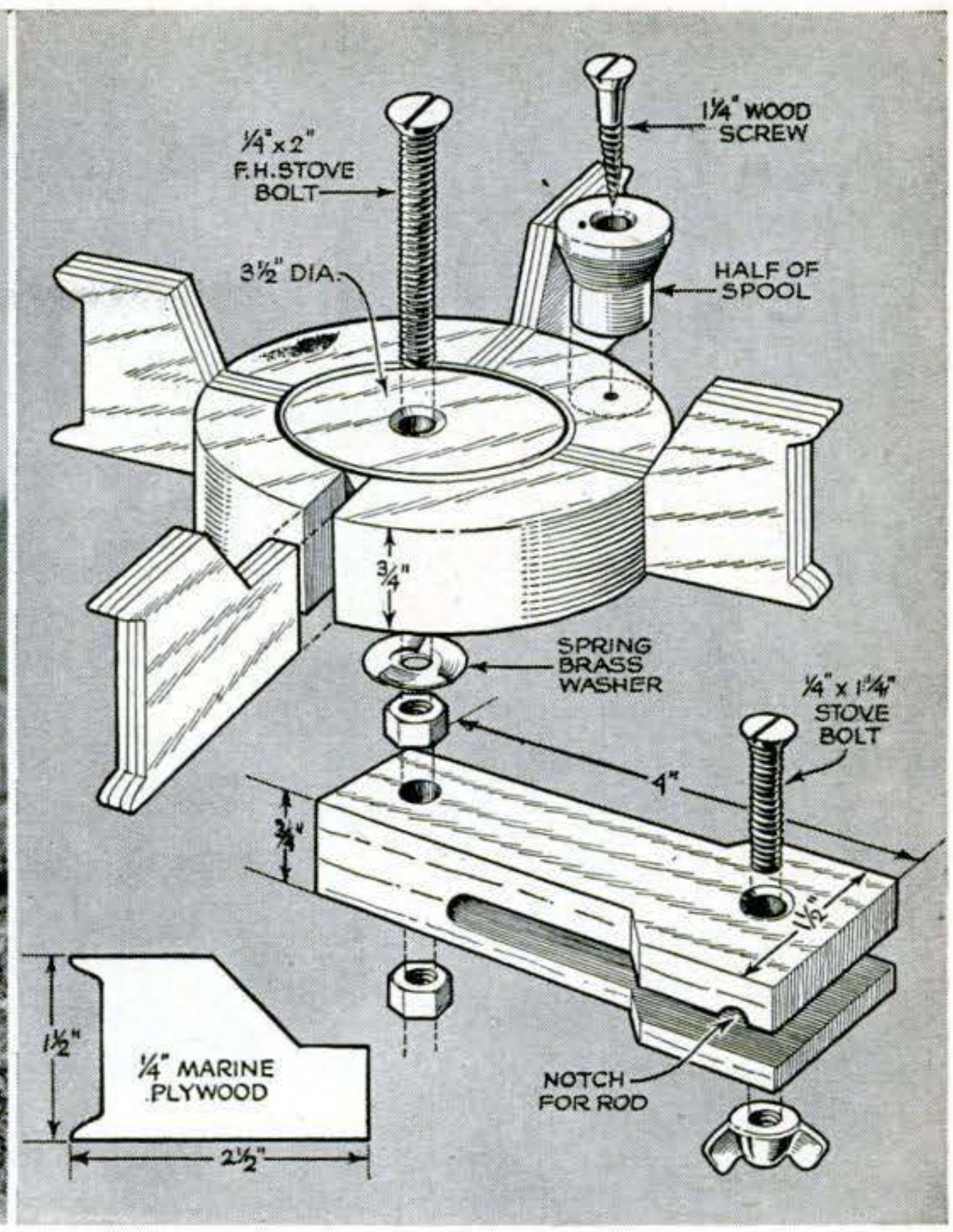
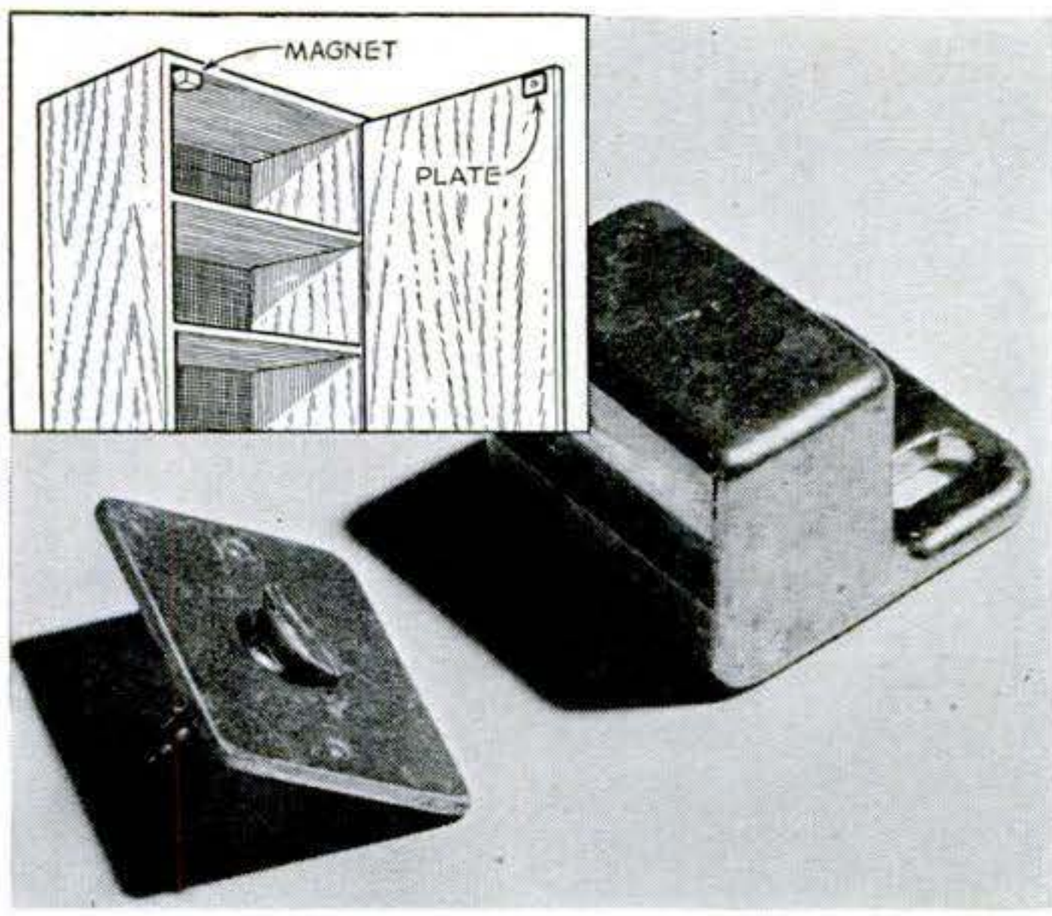




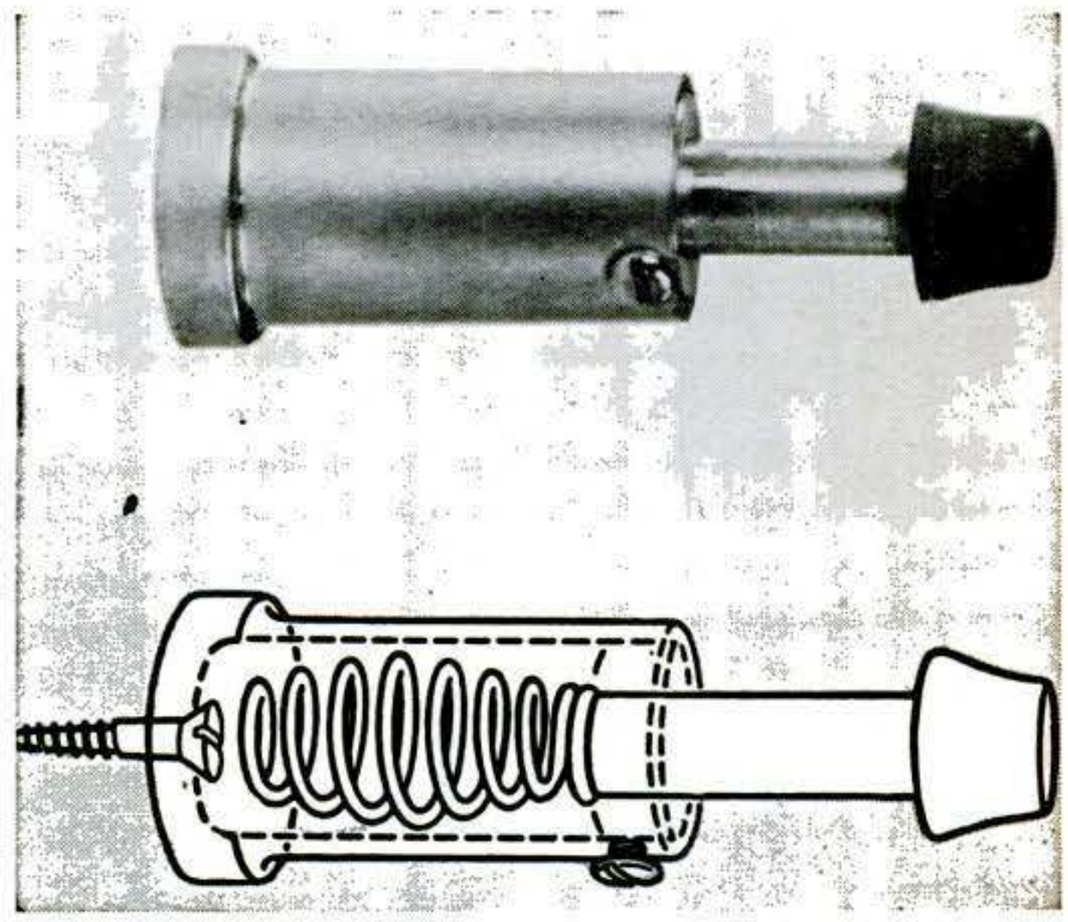
Drying Reel for Fishing Line Clamps to Rod

If a fishing line isn't properly dried after use it will quickly rot and become useless. The drying reel shown here is very convenient. You can wind the line directly from the fishing reel, and when it's dry, wind it back again. Hard maple is a good construction material, although a softwood can be used. The spring-brass washer is used to provide tension against the reel.—*Ralph S. Wilkes, Keuka Park, N. Y.*



Magnet Latches Cabinet Door

Cupboard doors that refuse to stay closed now can be held shut by a permanent magnet. Called Leco-Latch® by the maker, Laboratory Equipment Co., St. Joseph, Mich., the magnet is screwed to the cabinet and a metal plate is screwed to the door. When the door is shut, the magnet holds it.



Doorstop Has Spring Cushion

The shattering noise of a door banging open against the doorstop or wall is hushed by this new gadget. Its spring gives under impact and cushions the shock. A rubber bumper on the plunger protects the finish on the door. The device is sold for about 50 cents by the Wesco Electric Co., of Chicago.

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Kitchen Oven Cooks Ceramics

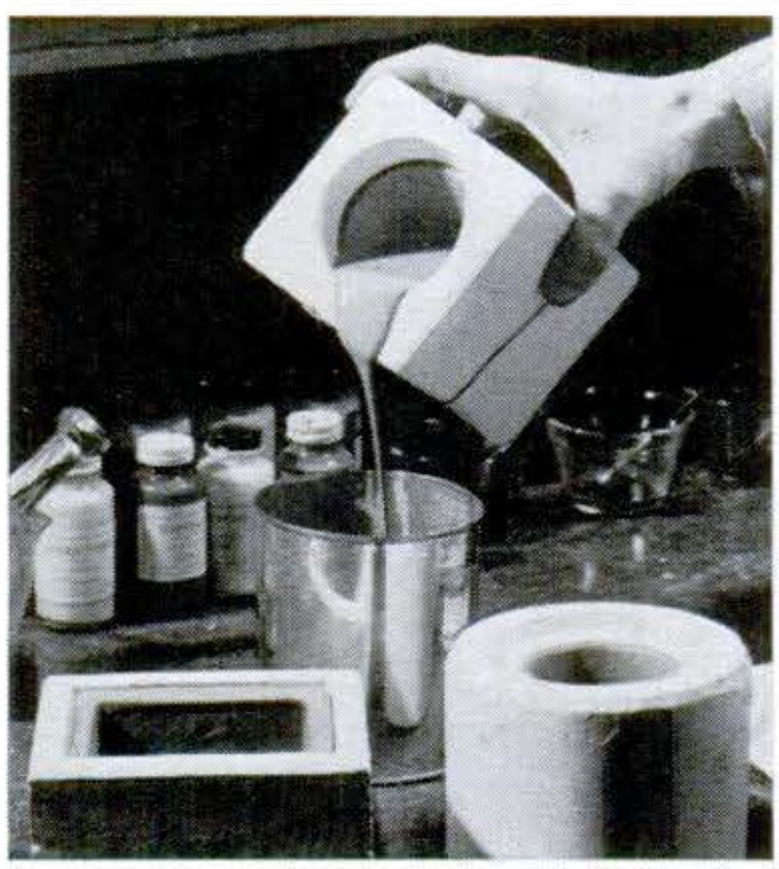
MANY a craftsman has been prevented from making ceramics by the cost of a high-temperature kiln. But nowadays you can get synthetic clays that can be "fired" or matured in a kitchen oven at temperatures from 150° to 300°. There is no odor, and the use of a kitchen oven for this purpose is not dangerous.

The castings shown above were made with a new material called Cerecast®, sold by the Plasticast Co., Palo Alto, Calif. They were colored with glazes prepared for use with this material. These glazes also harden at oven temperatures and are easier to use than true ceramic glazes because they have the same color before they are fired that they have afterwards.

The makers of Cerecast say that it is not as strong as true ceramics, but neither is it as subject to shock as the real stuff. Thanks to its greater resiliency, this new material does not break as easily.

1 **Ceracast®,** which comes as a liquid, is poured from the container into a plaster mold. A layer of the composition hardens on the walls of the mold. The rest remains fluid.

2 **After 15 minutes** the liquid part is poured back into the container. It can be used again. The part adhering to mold is given 10 more minutes to dry hard.



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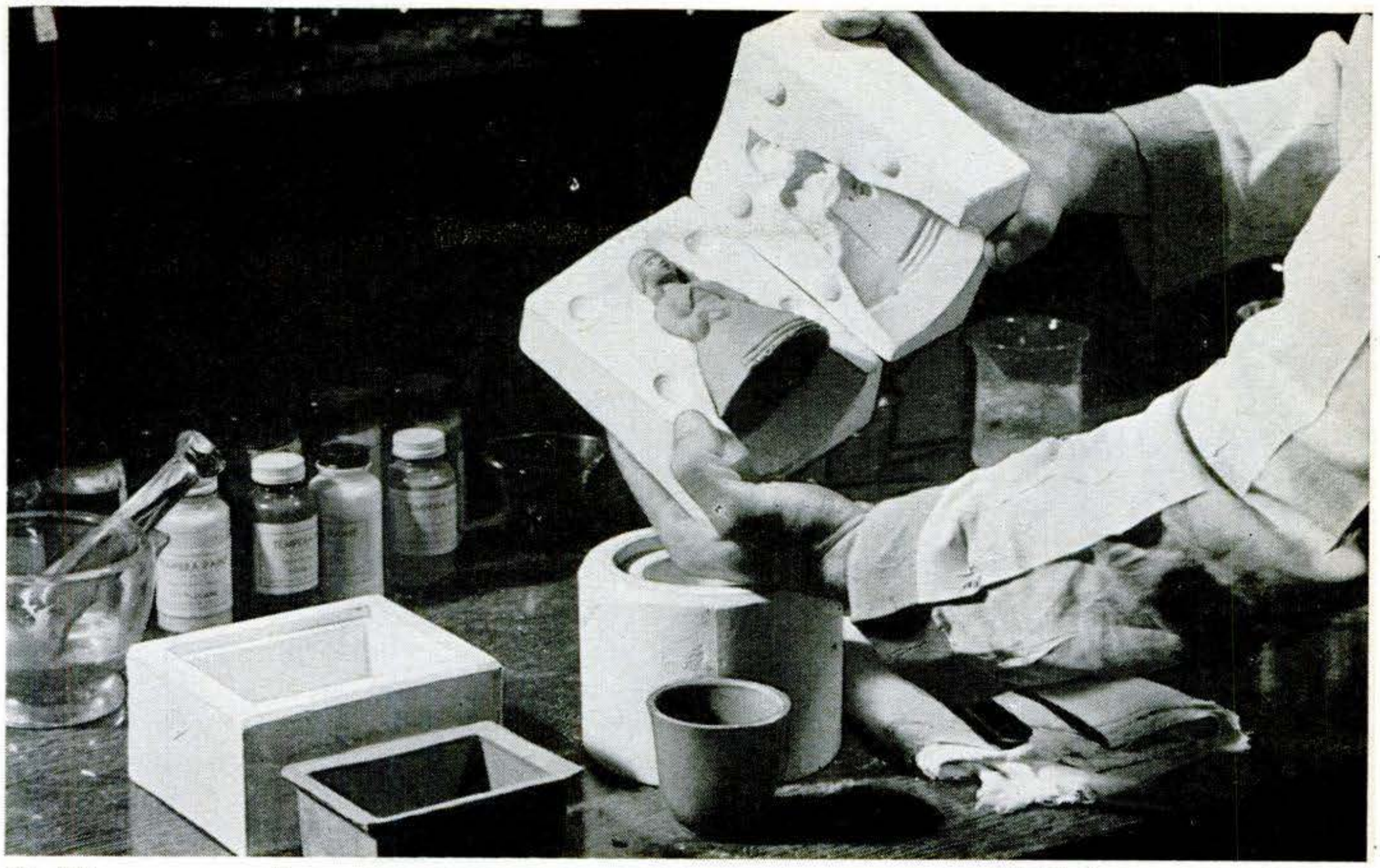
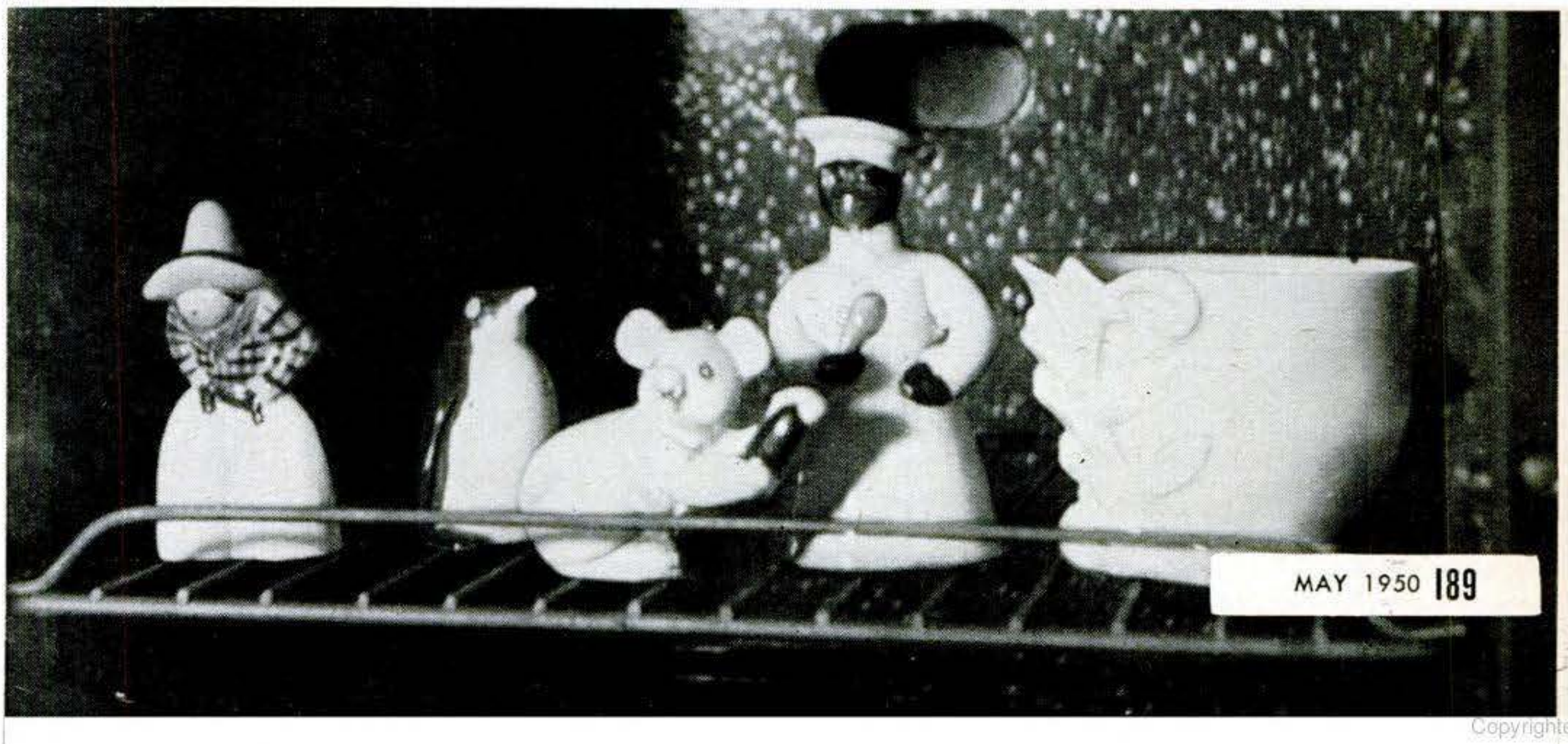


3 **To remove** castings from molds, the one-piece units (foreground) are simply inverted. The two-piece mold is untied. Material comes out easily because it shrinks.

4 **When removed** from mold, casting has rough spots trimmed off. Next, it is baked in oven for 30 minutes at 250°. It can then be decorated with colored glazes or tempera paints.

5 **Glazed pieces** are put back in oven for 15 minutes for surface hardening. Painted articles can be covered with a clear glaze. Baking makes the coating glossy and scratchproof.



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Aluminum and hardwood are combined in this serving tray. For contrast, use copper for rails.

Mother's Day Gift . . .

A Table or Tray

MOTHER will be proud to receive either one of these gifts—the coffee table with mirror top or the gleaming aluminum tray with polished hardwood handles. Both are simple projects.

Table. Dimensions of the top depend on the mirror—in this case an inexpensive 14″ by 20″ size. Rabbet the rails ¼″ and deep enough to bring the top of the mirror about ⅛″ below the top of the rails. The ends of the rails must be sawed square to hold the legs vertical. Rabbet the upper inside corners of the legs as shown in the drawing below. Assemble rails and legs with four brackets made from ¾″ plywood. Glue and nail the brackets to the rails and fasten them to the legs with wood screws.

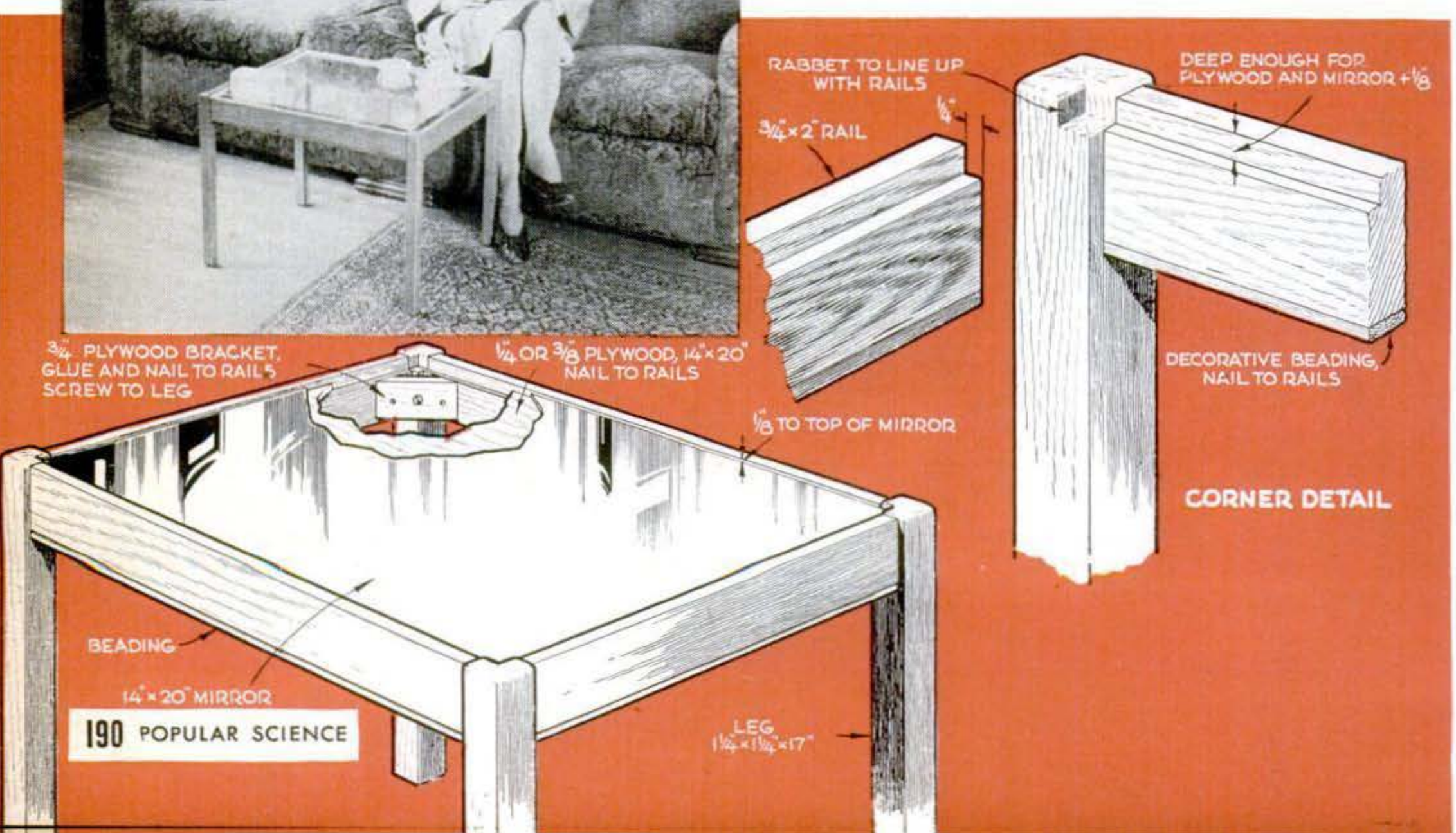
A strip of decorative beading, tacked to the bottom edges of the rails, adds to the appearance. Nail the 14″ by 20″ plywood backing plate to the rails with light finishing nails. Suit yourself about the finish you give the table and install the mirror by simply setting it in place.

Tray. Serving trays, of course, all do the same job, but attractive ones like this are decorative pieces even when not in use. You don't need more than an evening's time to make it and the materials are readily available.

To make the handles, use a coping saw to cut a 6″ o.d. circle from ¾″ hardwood. The inside diameter is 5″. Then cut the circle in two. Saw tight-fitting grooves halfway through the handles for the 1/16″ aluminum. Make a few trial cuts in scrap with a coping saw or hacksaw before putting the grooves in the wood. To secure the aluminum tightly, drill holes at angles up from the bottom of the handles and through the aluminum. Countersink finishing nails in the holes.

The aluminum sheet measures 8¼″ by 12″. Round off the corners to a ½″ radius, and then bend them up. Use ¼″ o.d. aluminum tubing (or copper for contrast) for the 9″ rails. Squeeze ½″ of each end in a vise and drill holes for a No. 8 roundheaded screw. The ½″ spacers also are ¼″ tubing. Locate the rails about ½″ in from the edges of the tray. Drill and tap the aluminum for the screws. Peen the screws after tightening and file them flush. The aluminum can be finished with emery and then steel wool, or given a silvery effect by wire brushing.

Graceful coffee table, below, with its mirror top, adds to the appearance of any living room.



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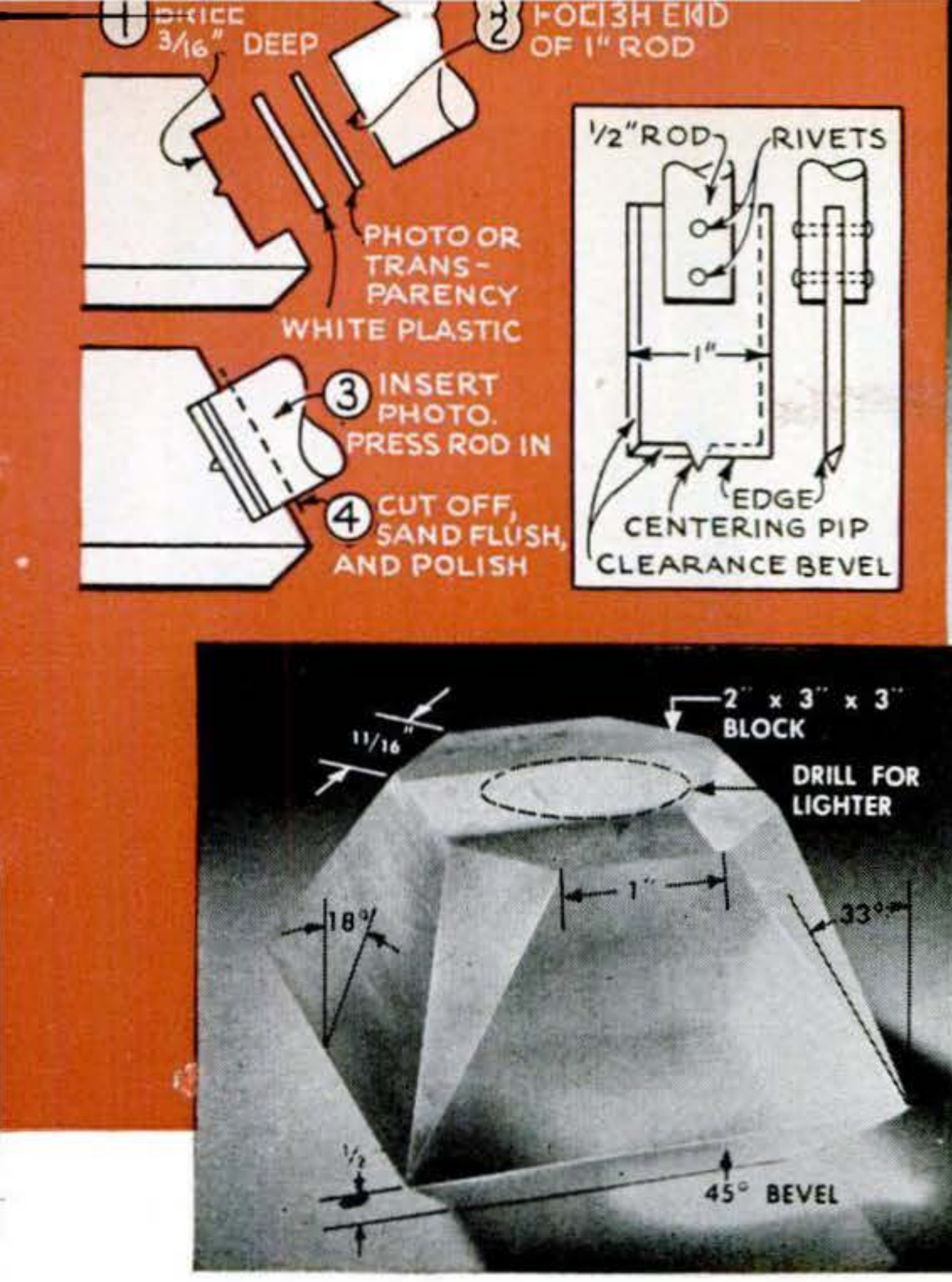
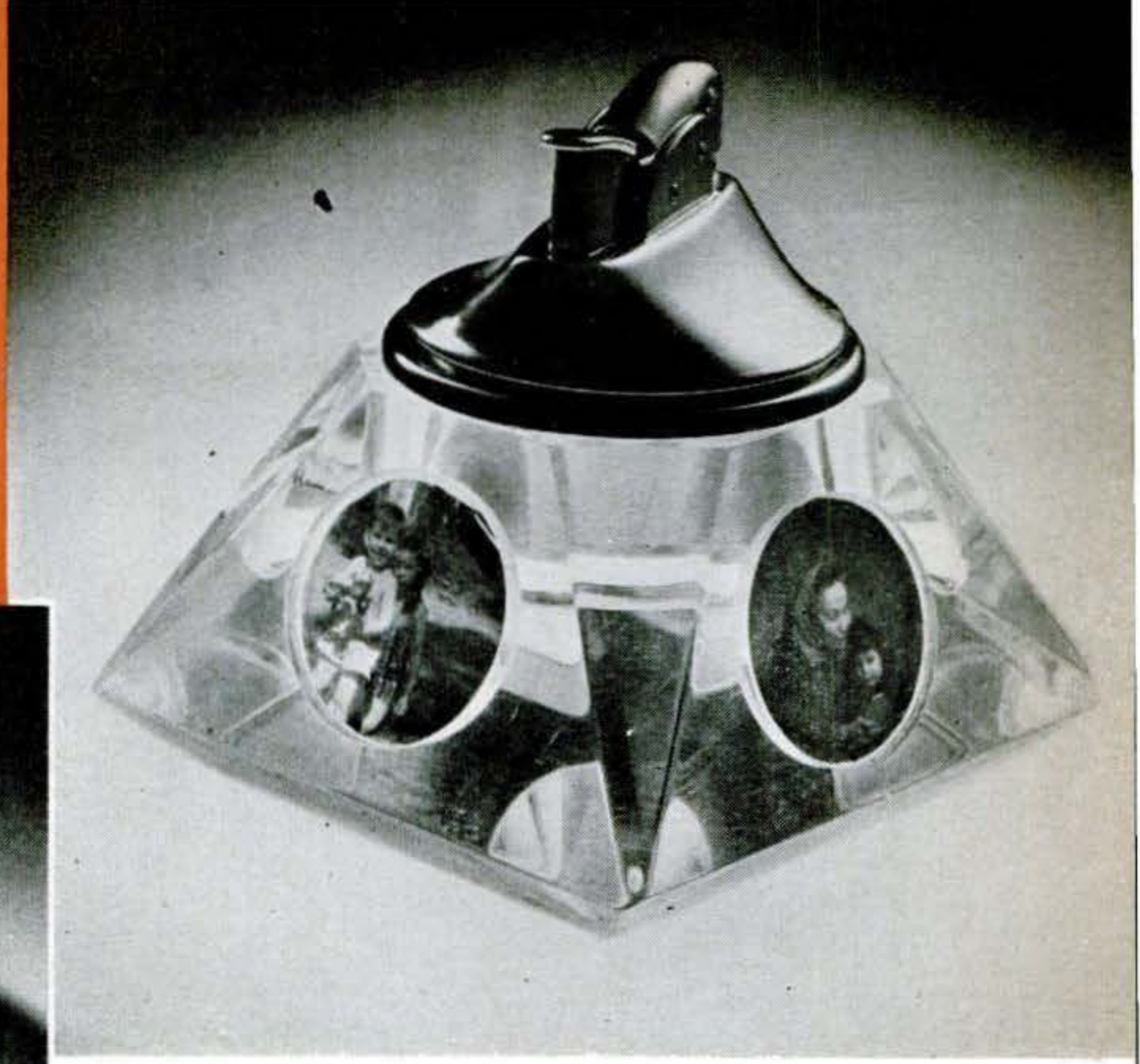




Picture your family and friends in a crystal lighter. Photos are permanently inset by method shown in the drawing. The block is first shaped as at the left.

Plastic Craftwork Everyone Admires

AS THRILLING a craft material as acrylic plastic is, it's doubly so when used for out-of-the-ordinary projects like these. The lighter above demonstrates a new technique in sealing photo cutouts into acrylic objects. Below is a vanity-table accessory that will strikingly display your skill in internal carving.

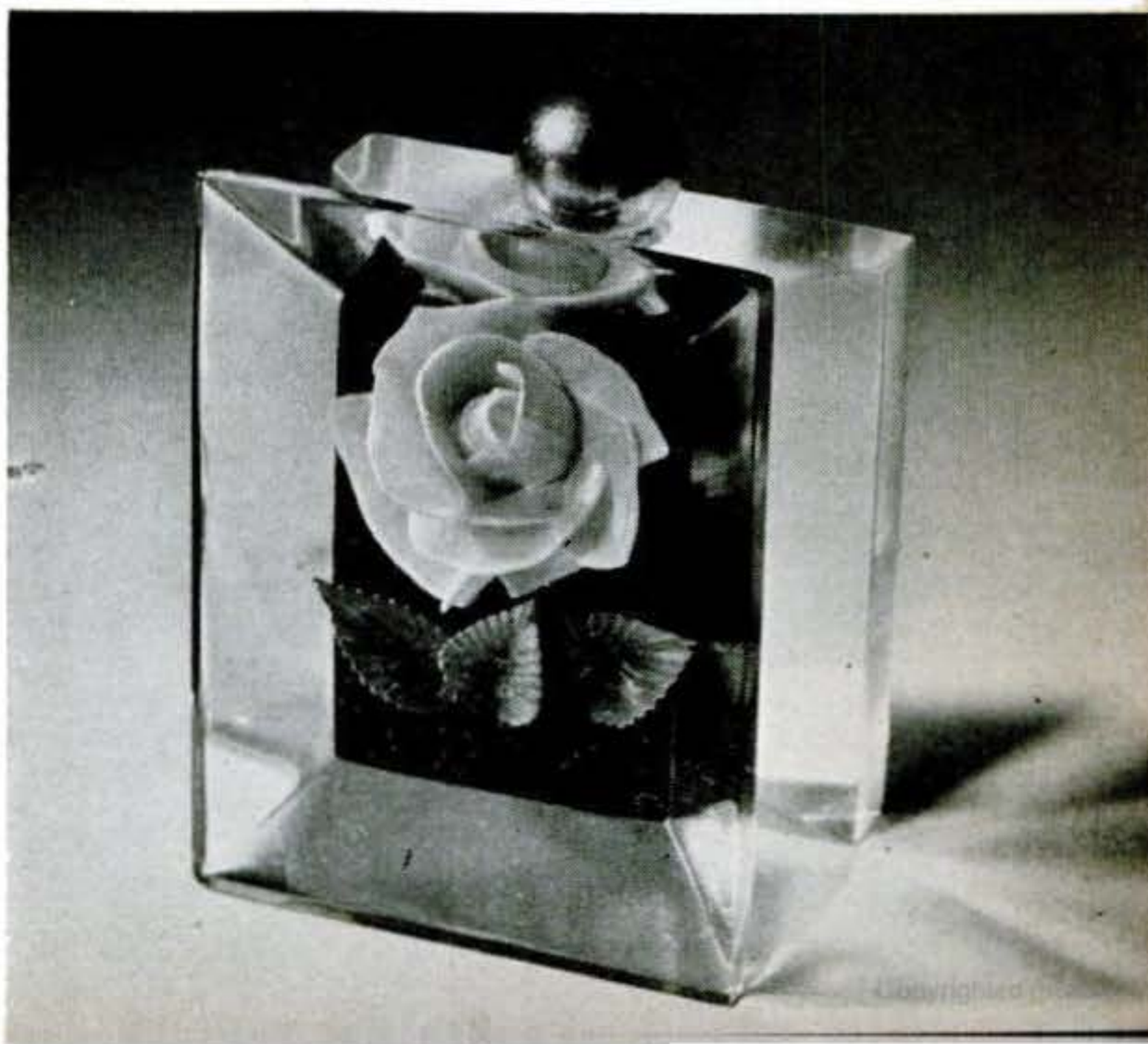
Photo Lighter. When visitors pick up this lighter, you've got a conversation rolling. If you prefer to turn it into a Mother's Day gift, you might drill a tapered hole in the top for a candle instead of the lighter unit, or mount a pen socket on it as a desk accessory.

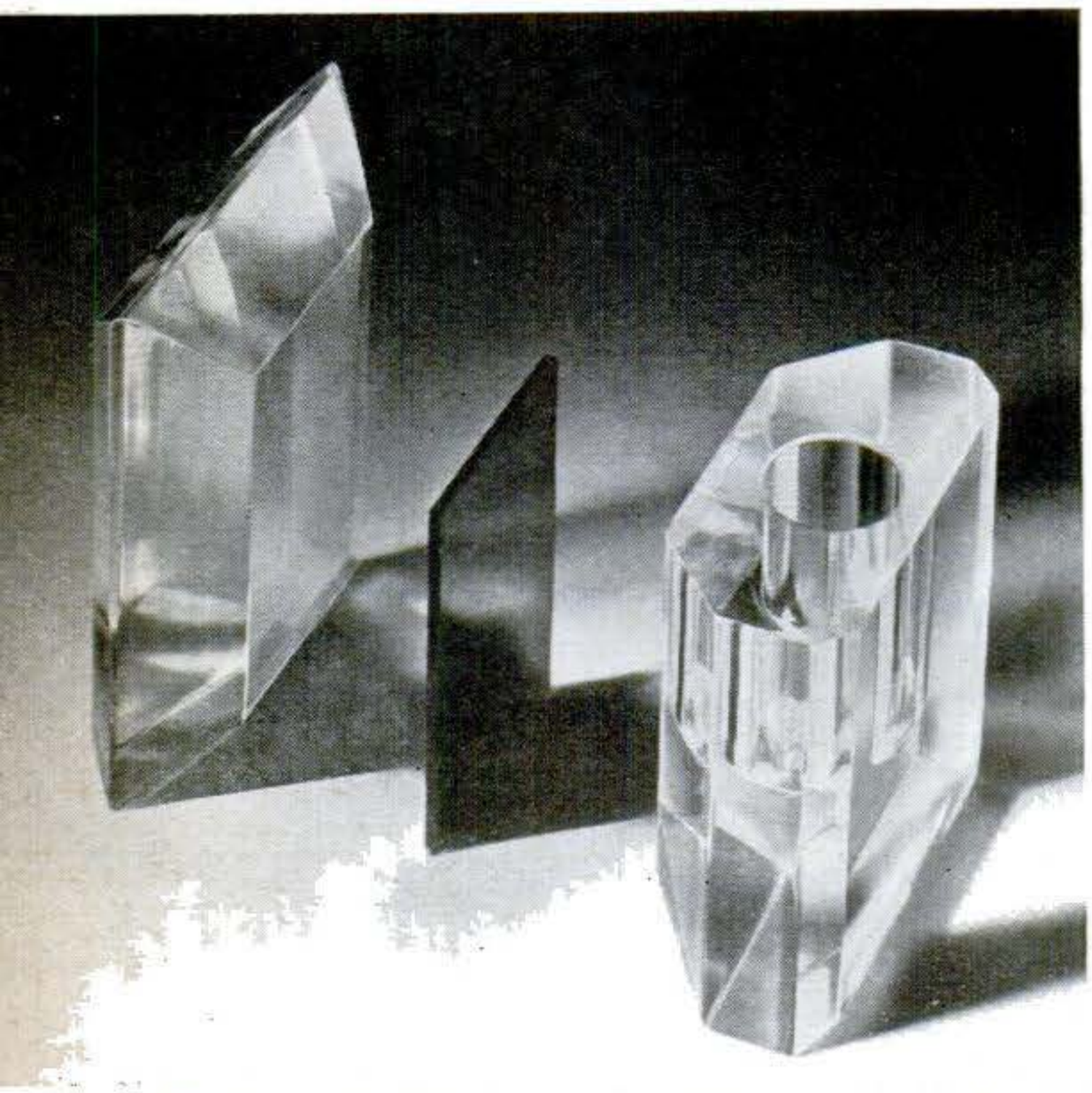
The method used to embed the photos, originated by Bert Horton of Berton Plastics, Inc., New York, requires neither heat nor cement. You do need a flat-bottom drill, which you can file from a bit of ⅛" steel. It should make a hole just a few thousandths undersize for 1" acrylic rod. The tool needn't be hardened. Be sure to file the clearance bevels on opposite sides of the edges so as to cut on clockwise rotation.

Cut and bevel a block of acrylic plastic, either as shown in the photo, or to a simple cube. Don't polish until photos have been inserted, following the steps in the drawing. Color transparencies should be light (over-exposed). A thin disk of translucent white plastic (or clear plastic frosted with sandpaper) goes under transparencies to hide the dimple left by the centering pip. For opaque color prints and ordinary black-and-white pictures this disk isn't necessary.

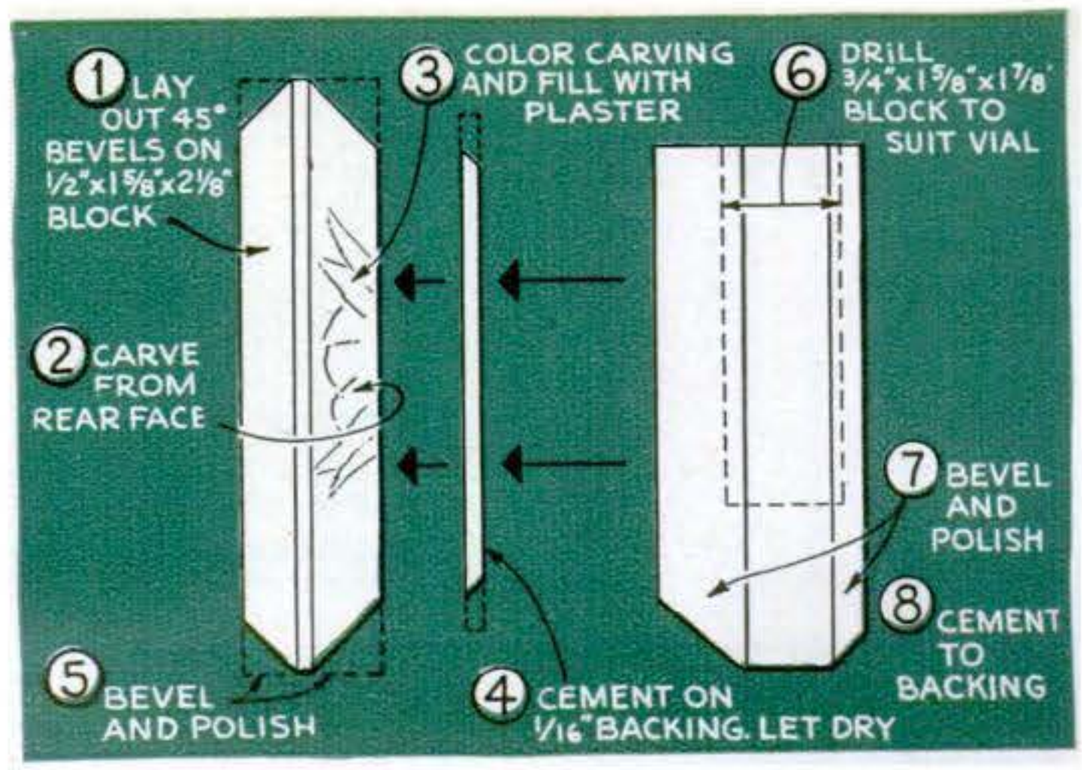
The steps in embedding the photos are shown in the drawing above. Drill the hole about ⅛" deep (a bit more for the ➧

One rose, carved in clear acrylic, is forever lovely in this jewel-faceted perfume holder.





Perfume holder is made of three pieces, shown beveled and in order of assembly. But do the carving and cement on backing before beveling.



extra translucent disk, if you're mounting transparencies). Face square and polish the end of a bit of 1″ rod. Put the photo in place, press in the rod, and cut off the projecting portion. Sand flush and polish.

A round lighter unit is easiest to mount. Make another flat drill, or bore the socket on a lathe before shaping the block.

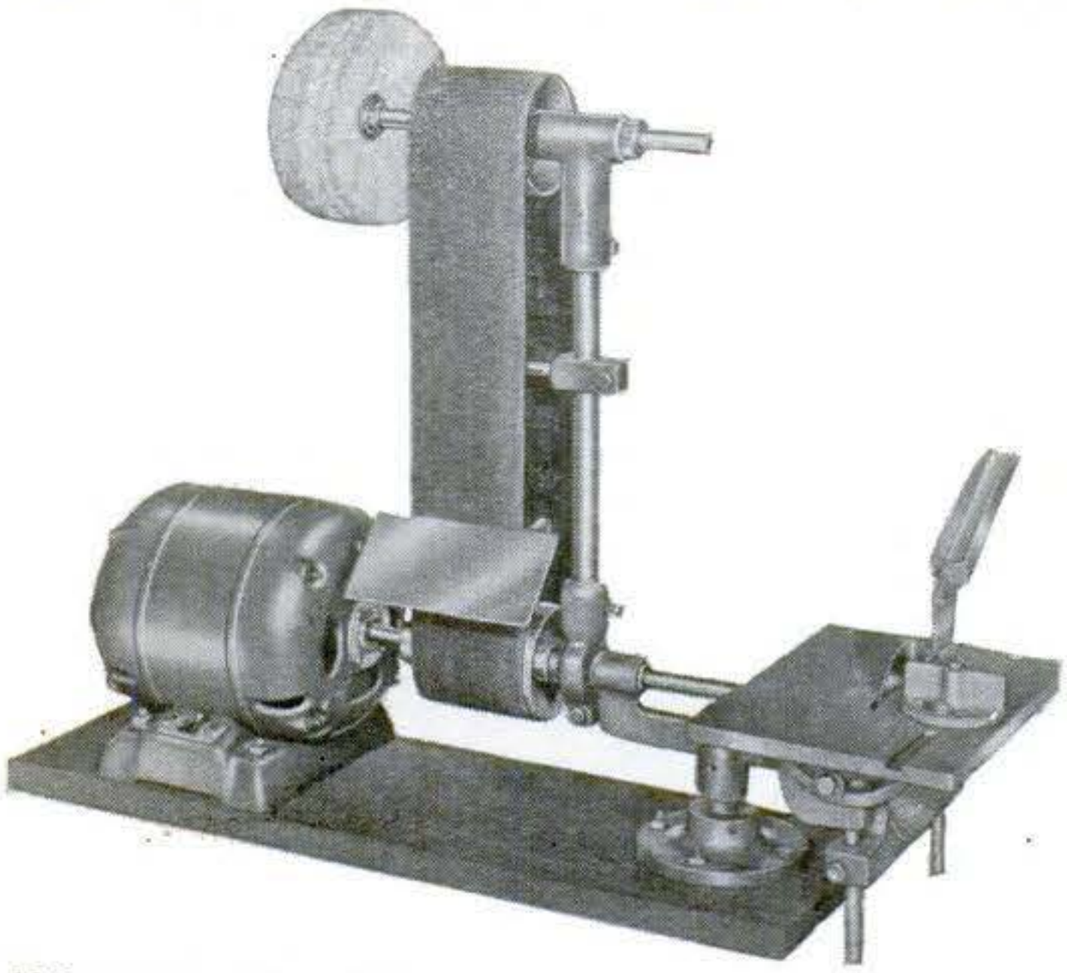
Perfume Holder. Here's an exquisite plastic accessory for a dressing table. The rose isn't too tough a project even for the beginner in internal carving (see PS, Aug. '47, page 160). If you're already an expert, you can substitute your favorite motif.

The photo at left shows how the blocks are beveled for maximum brilliance. Actually, the front should be carved and its backing cemented on before faceting.

Mark out the bevels on the block so that you can keep the carving within limits. After filling the carving with plaster and sanding the back perfectly flat, cement on an oversize backing of 1/16″ opaque sheet plastic. Black sets off most flowers especially well. Soak one face of the backing in solvent (chloroform or ethylene dichloride). Lower it against the other surface, starting at one edge to let air bubbles work out, and clamp lightly.

Let dry overnight before forming the 45° bevels (since any bubbles will be around the edges, beveling will cut them away). Drill a hole in ¾″ stock for the perfume vial. The hole can be left frosted by sanding with abrasive paper wrapped around a rod, or polished with solvent. Pour it full, let stand a short time, and pour out the solvent. Bevel, polish, and cement this piece to the backing.—*M. J. Moch, Jamaica, N. Y.*

Combination Tool Is Complete Plastic Workshop



MULTI-PURPOSE power tools have become fairly widespread in home woodworking shops. Now comes a combination containing the tools most often needed for fabricating plastics. Developed by Berton Plastics, Inc., New York, and retailing for about $40 without motor, the tool features a 4″ tilting-table circular saw, a belt sander, and buffing wheel. All tools are ready for use at all times. The sander, which has a removable dam, can be used either vertically or horizontally. The buffing-wheel arbor will also take a grinding wheel or drill chuck. Compact enough for kitchen-table use, the tool is sufficiently husky for light woodworking chores.

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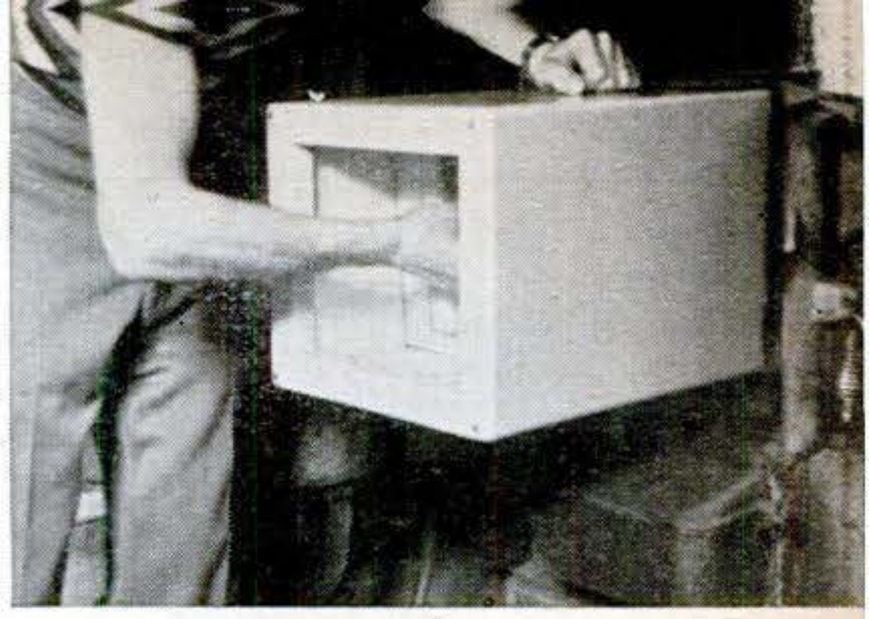
Sliding Bottom Empties This Wastebasket Fast



IF YOU'RE tired of emptying wastebaskets by the handful, you'll appreciate the cleanliness and convenience of this basket. It looks like any other handsome waste receiver, but the sliding bottom pushes the contents out in a jiffy.

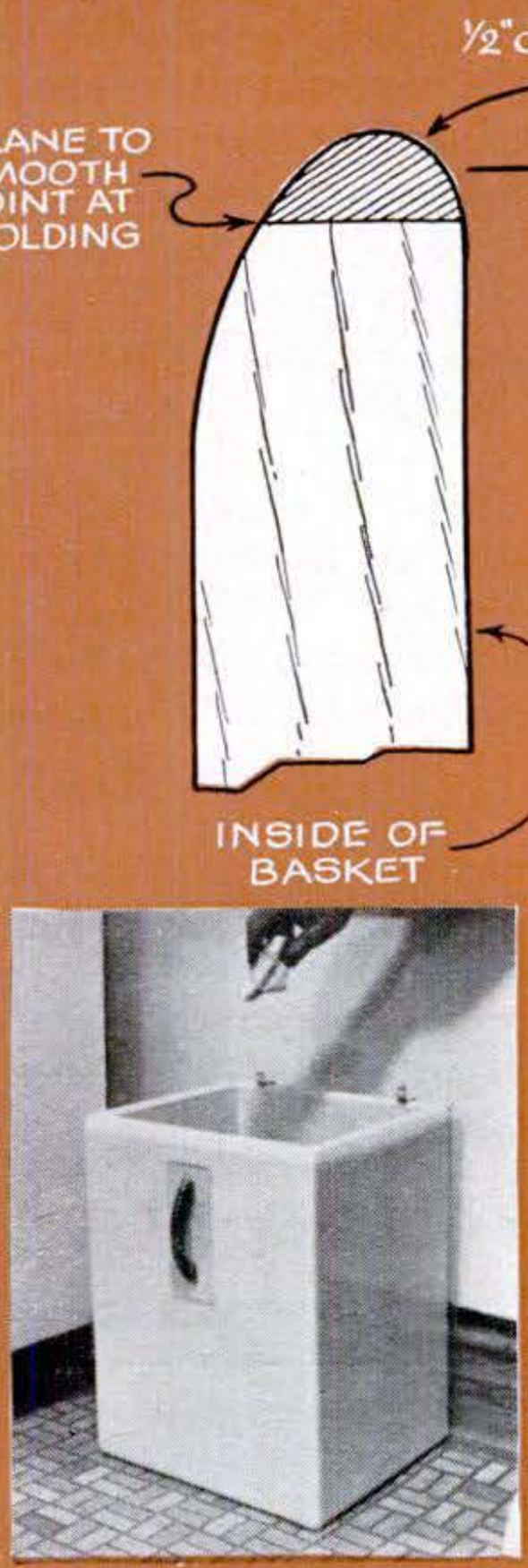
The basket shown, built of stock-size lumber, is convenient for most rooms. However, you may wish to change the dimensions to fit a particular incinerator or furnace door. If you plan to enamel the basket, the lumber needn't be of the best grade. Stain or natural finishes may require better stock.

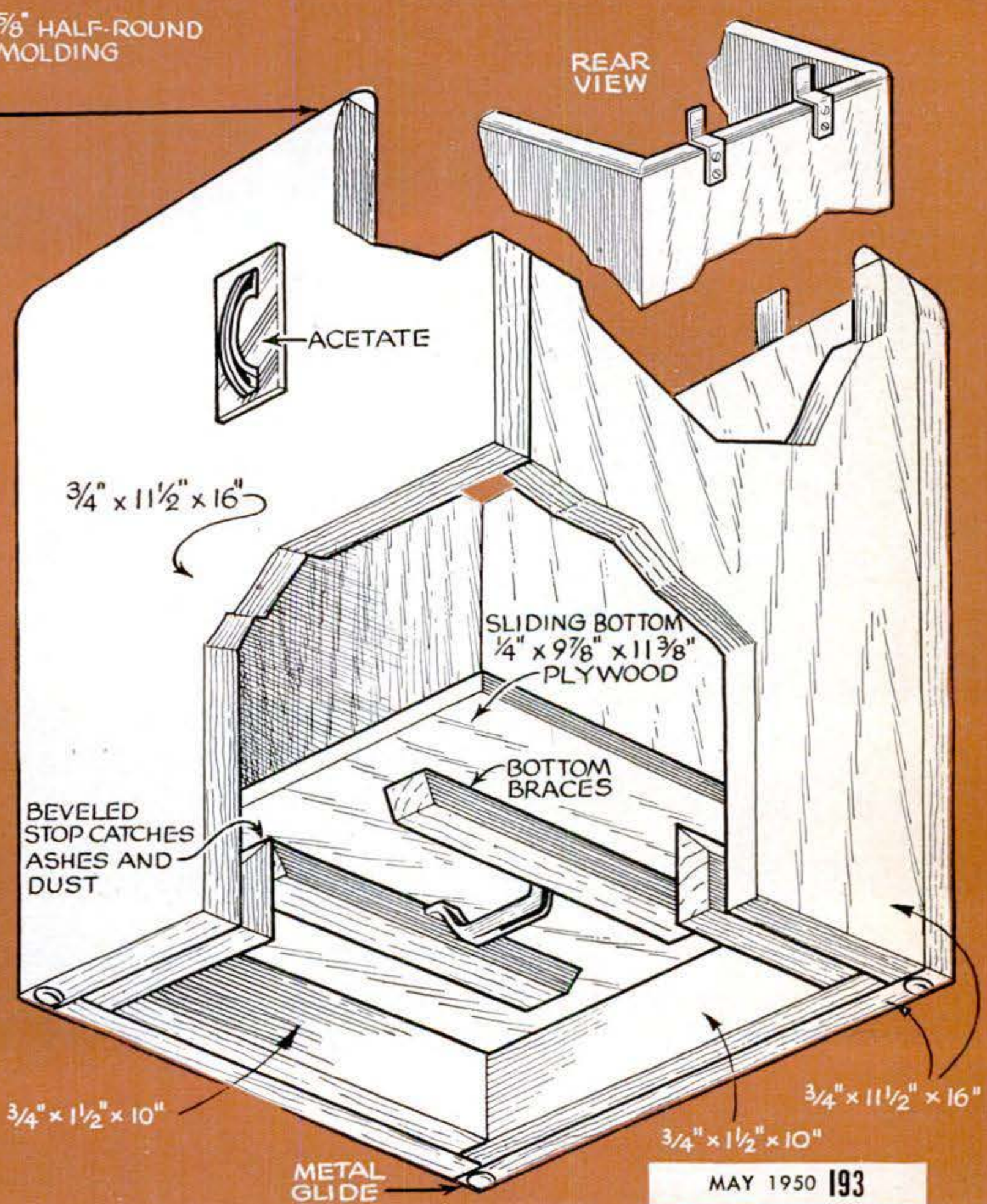
Sides are glued and screwed together, the screw heads being countersunk and covered with composition wood. Beveled strips around the inside bottom can be nailed in next. The bevel traps small particles of dirt and ashes that seep past the sliding bottom.

Half-round molding around the top improves the appearance of the basket. Strips ⅝″ in diameter are used and the outer faces of the ¾″ stock are planed to blend smoothly with the molding.

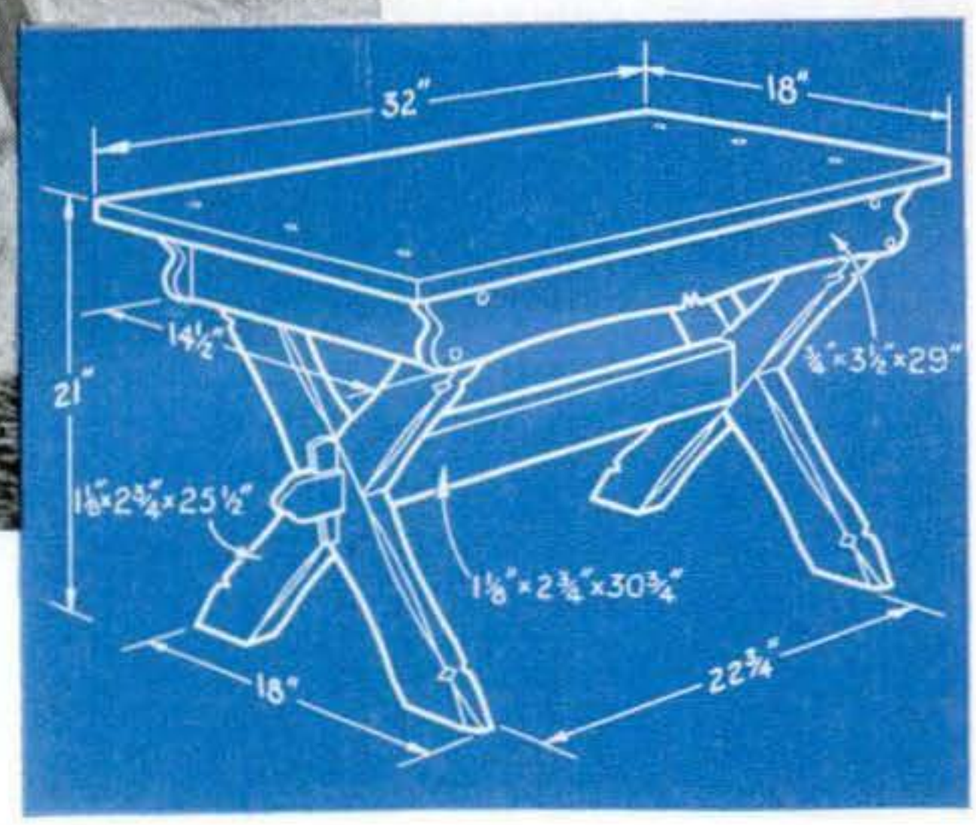
Plywood is a good material for the bottom. The ¼″ thickness is reinforced by two braces. Both the braces and handle are attached by screws from inside.

Two metal hooks, shown in the rear view, are placed to catch on the lip of a furnace opening. They steady the basket while it is being emptied. A 3″ by 6″ piece of acetate or clear plastic between the upper handle and the basket protects the side from finger marks.—*Robert Hoppough, Waukegan, Ill.*

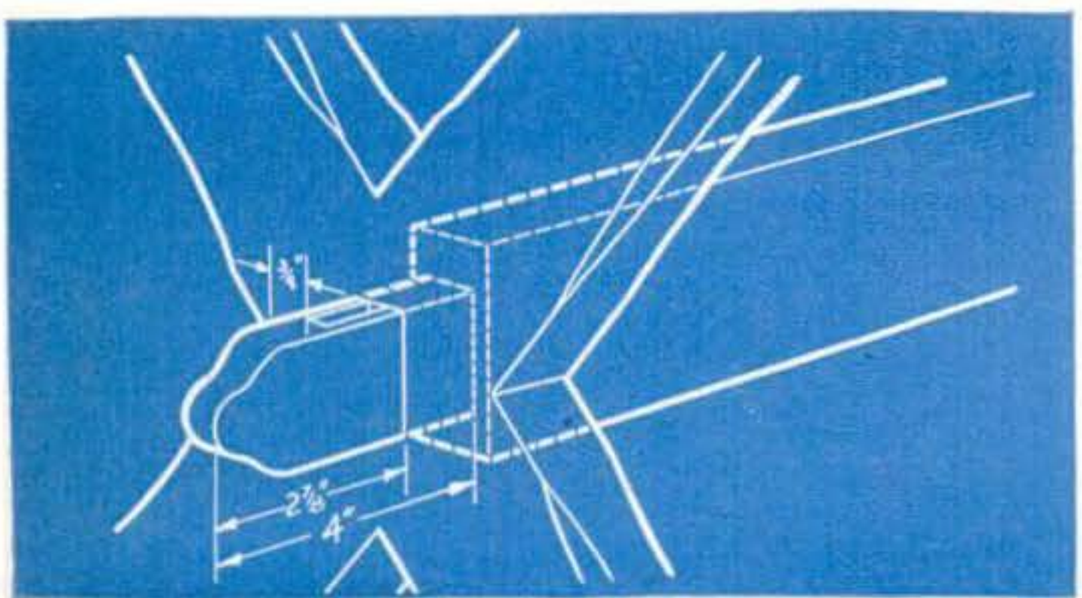


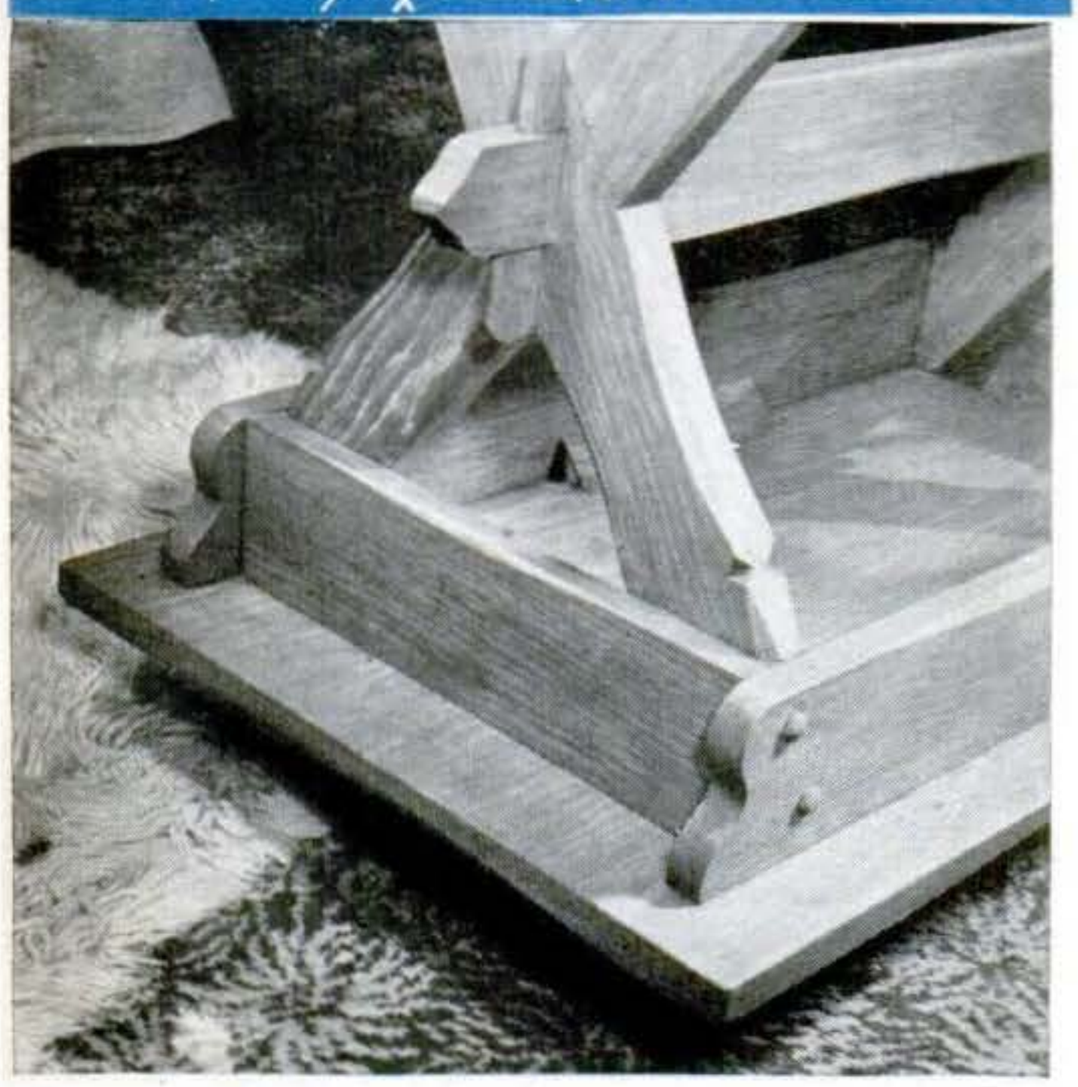


Finished table, left, is a substantial piece of furniture. Drawing below gives you the dimensions. Screws in top are covered by dowel plugs to simulate peg construction.



Trestle Table Built of Pine





Tongue of the center brace is proportioned as in drawing above. Legs are cut to fit sides.

HERE'S a rugged, good-looking table that's a little bit different from the usual cocktail table. It's made of clear white pine, stained, and given three coats of wax.

The top is glued up to get the proper width. There's a half-lap joint where the legs cross. These joints are glued. After the glue has set, the slot to take the tongue of the center brace can be cut. The slot in the tongue is cut so a little of it is covered by the legs. Then, when the wedge is driven home, you'll be sure to get a tight fit.

The side skirt pieces are drilled, and then doweled and glued to the end sections and to the legs. Half-inch dowel plugs cover the counterbored screws that hold the top to the ends. Chamfering the edges of the legs and side skirts gives an added touch to the piece. The edges of the top and center brace are rounded off to simulate worn edges. Sand the table well before staining it.—*L. T. Cronk, White Plains, N. Y.*

Key-ring Screwdrivers

DON'T throw away old unused keys. A very useful set of screwdrivers can be made from them. Simply file off the teeth and file the end into a screwdriver blade. A whole set of many sizes can be kept handy on a key ring.—*Donald Barry, East Orange, N. J.*

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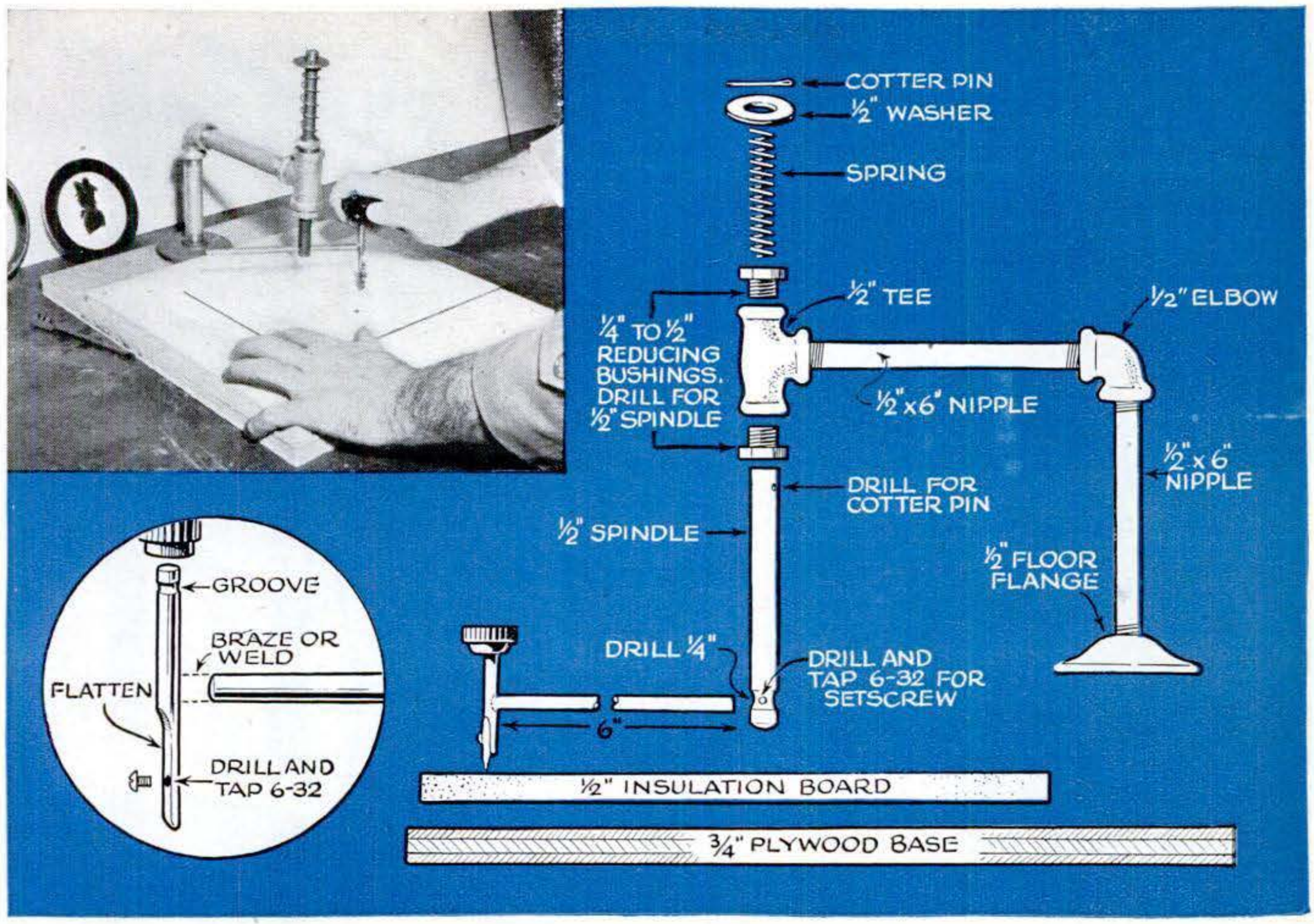
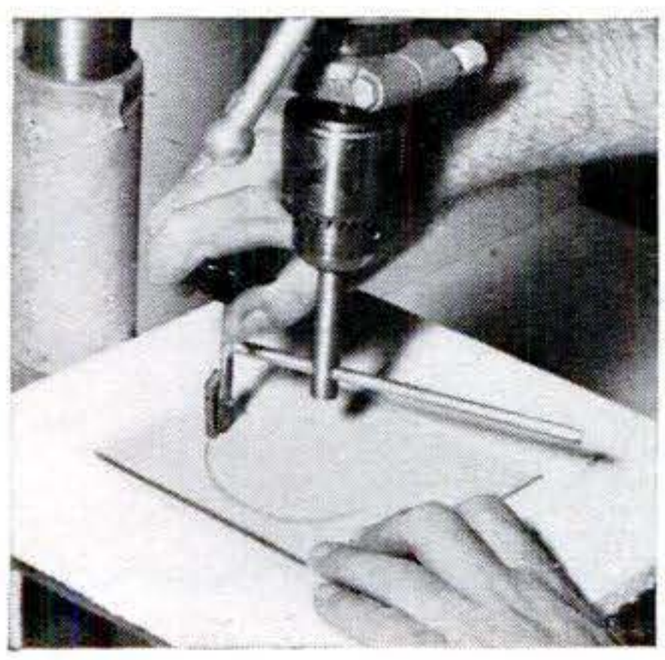


Tool Cuts Perfect Circles in Glass

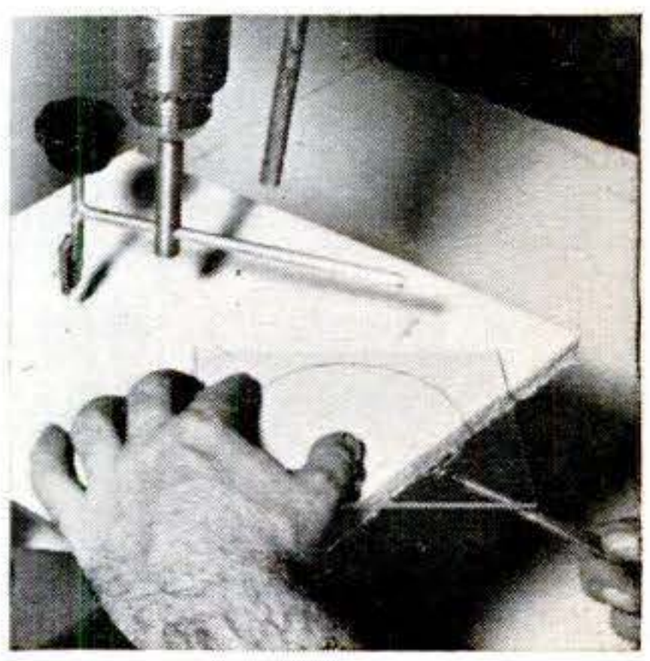
EVER need a glass disk—for a circular picture frame, instrument dial, or perhaps a flashlight lens? With this simple, inexpensive tool you can make such cutouts. You can use it with the pipe bracket shown above, or you can chuck it in a drill press.

The drawing shows you how to proportion the parts. If you use the tool in the pipe bracket, cut a 7″ spindle of ½″ drill rod or cold-rolled steel. For a drill press, the spindle need be only ¼″ by 3½″. Turn a groove at one end of the spindle to take the setscrew of a radio knob. Flatten about 1″ of the other end. About ½″ from the flattened end, drill and tap a hole for a 6-32 screw. Cut the handle off a wheel-type glass cutter at the beginning of the flat section and attach the cutter to the flat end of the spindle with the screw. The other dimensions depend on size of circle you want to cut.

If you don't have a drill press, make the pipe bracket. The spindle bearings are made by drilling or reaming two bushings to take the ½″ spindle. These are inserted in a tee that is supported as shown in the drawing and photo. Insert the spindle and put the spring on it. Adjust the spring tension to hold the cutter about ½″ above the glass. Slight pressure on the knob will force the cutter down on the glass to make the cut. The photos below show you how to use the cutter.—*Evan Wright, Topeka, Kans.*



How to use cutter: To cushion glass, put it on piece of heavy insulating board or wood covered with carpeting. Wipe line of cut with turpentine. Bear down on knob until you feel wheel bite into glass. Make one complete circle. Then, using ball on end of glass cutter, tap along cut on underside of glass. If cut is properly made, crack will start. It may be necessary to make some tangential cuts to remove disk.



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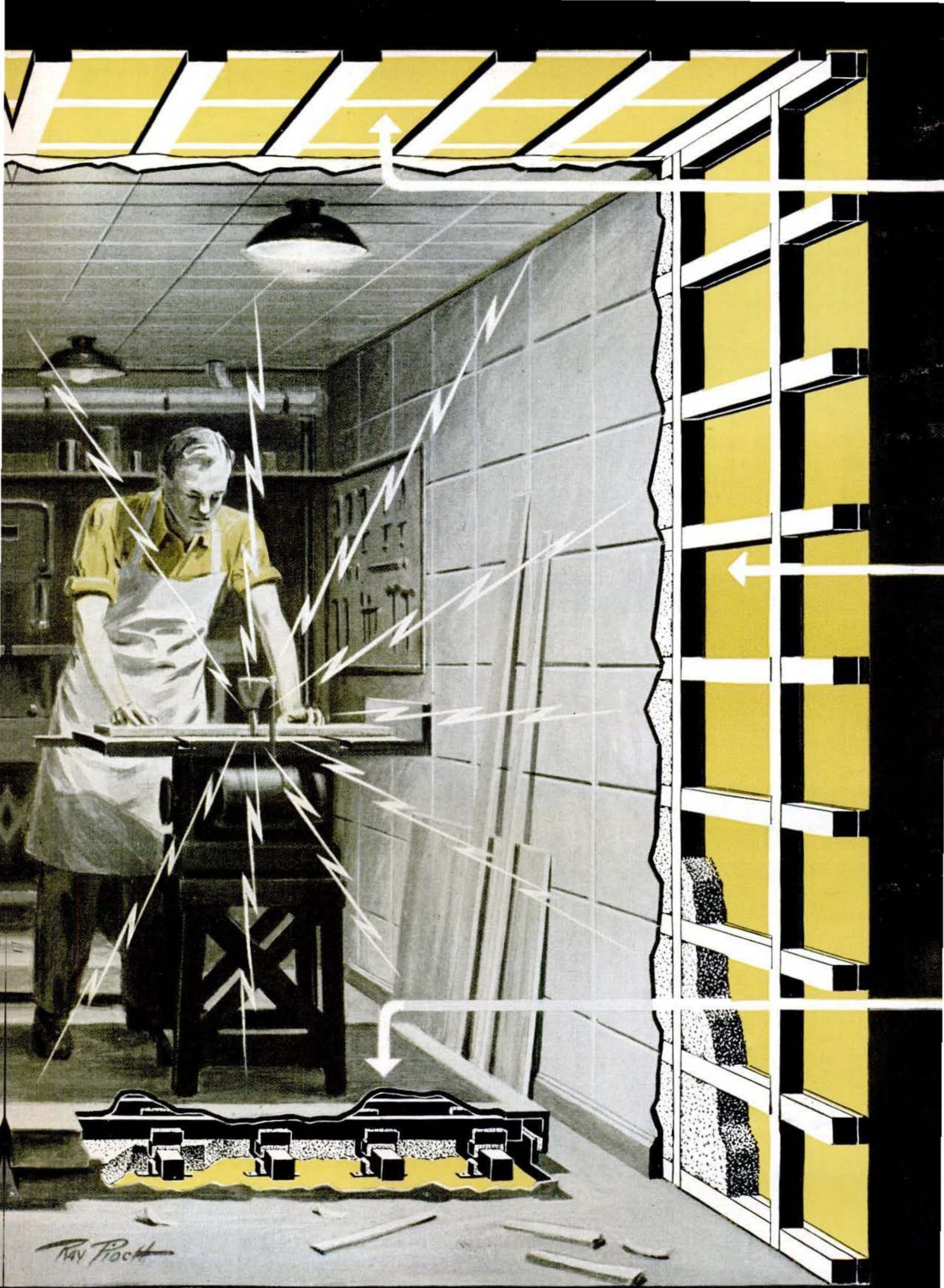

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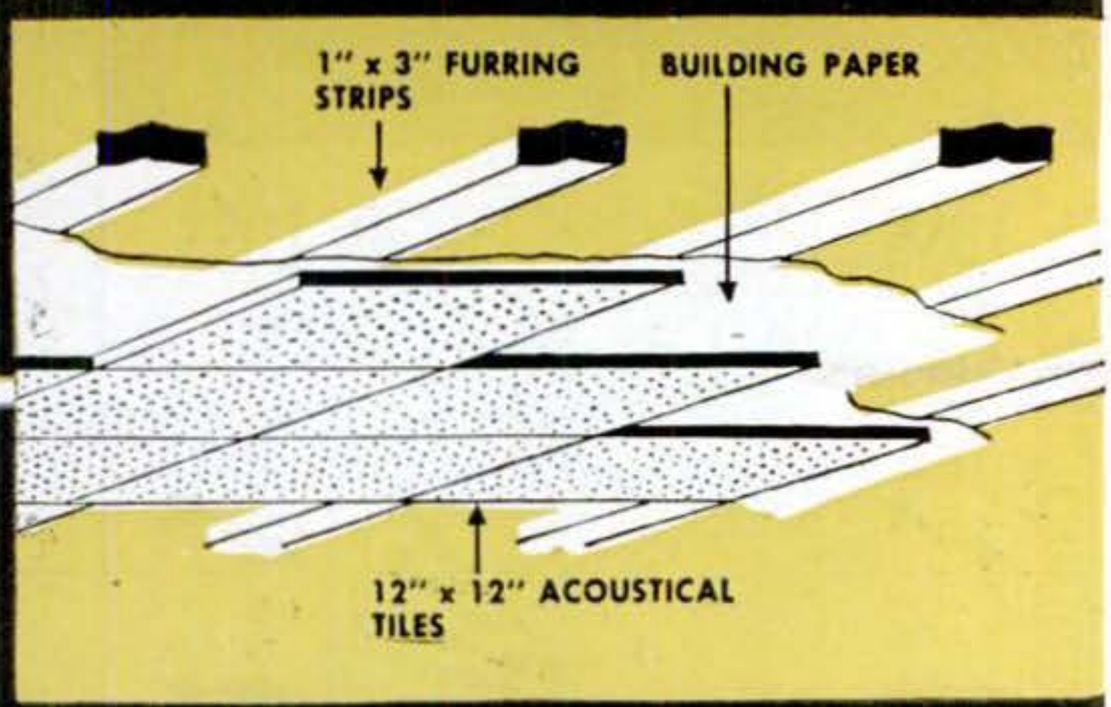

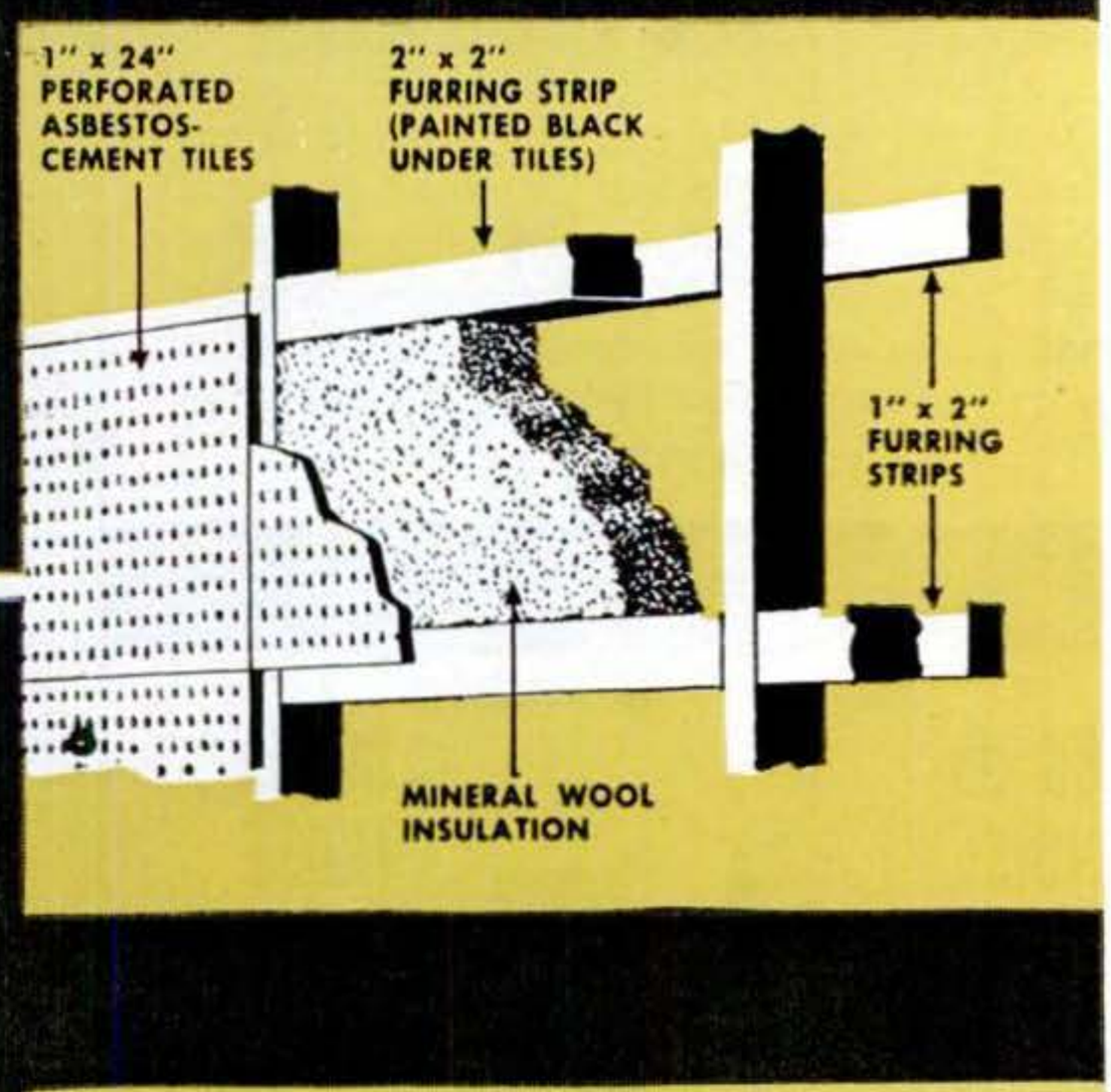

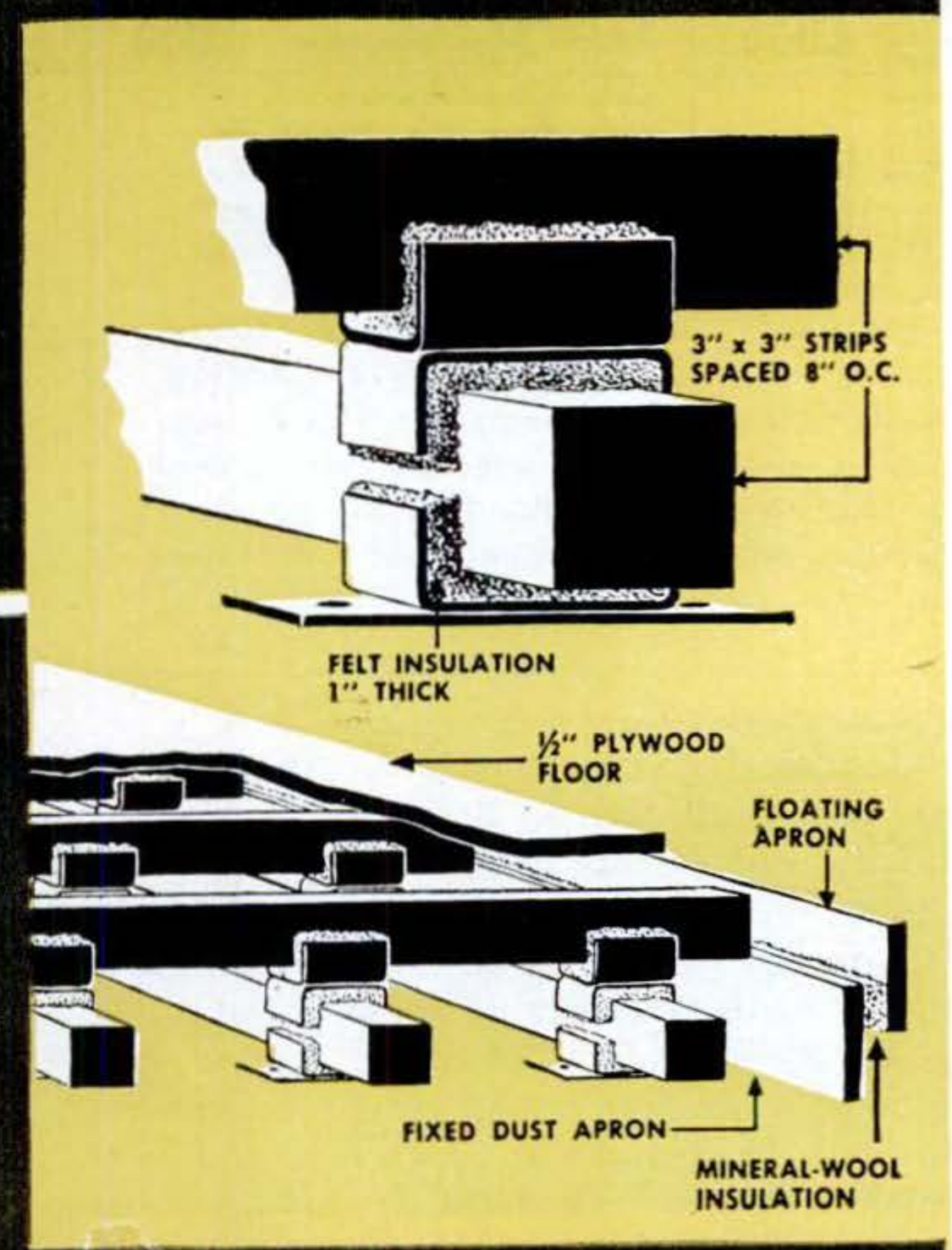

Soundproofing Your Shop

If the siren sound of a circular saw or the thump of a jigsaw makes your shop a nuisance, here's what you can do.

By Arthur C. Miller

Drawings by Ray Pioch

DOES your family complain when you run your bench saw late at night? Have you been kept from enjoying your shop by someone's illness? Or are you getting along without power tools because you live in an apartment and don't want to annoy the neighbors?

It's possible to tone down much of the noise and vibration, depending on the kind of tools you have and in what part of the house your shop is located. While most shops are in the basement, an increasing number of them must be located elsewhere. Many new homes don't have a basement. This brings up the problem of stopping not only airborne sounds but also the vibrations set up by power tools mounted on joist-supported wooden floors.

Basement Easiest to Soundproof

A basement, if you can use it, is probably the easiest spot to soundproof. There the tools sit on a concrete floor that absorbs most of the vibration. Airborne noises are the main problem. Most of these can be stopped by covering the walls and ceiling with acoustical panels backed by insulating batts.

But if your shop is upstairs with the tools mounted on a wooden floor, your noise and vibration problems are multiplied. You've got to stop the vibrations the tools transmit to the floor and you've got to tone down the airborne noises.

Vibration is a major mischief-maker as far as power tools are concerned. Take a good-sized screw-cutting lathe, for exam-

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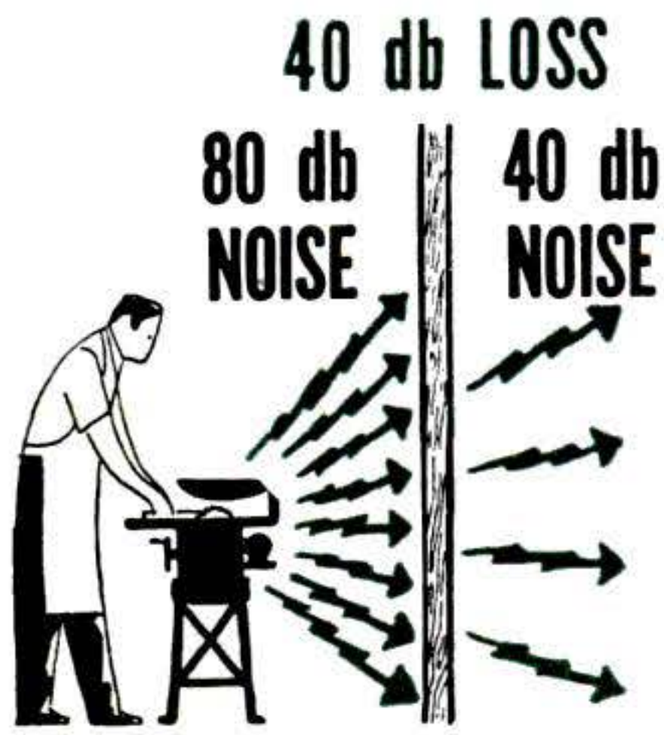
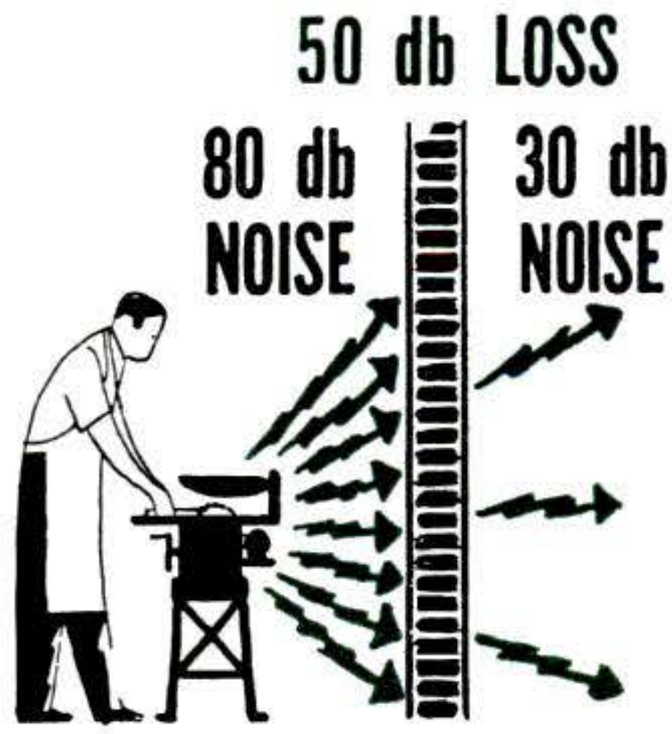
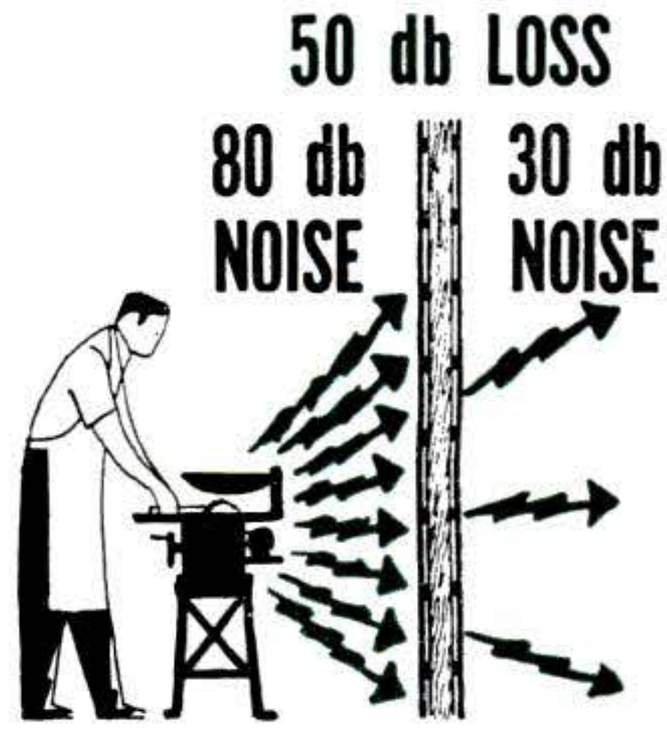
DECIBEL LOSS THROUGH WALLS



Standard walls are poor traps for noise. Fifty percent of noise from a bench saw leaks out through the plaster on lath and wood studding.

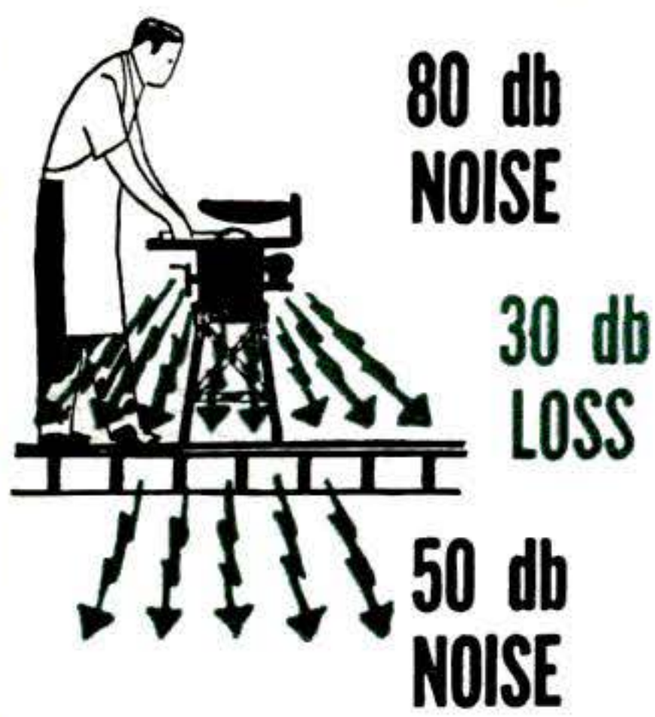


An 8" thick brick wall with plaster is a better sound absorber. Thirty decibels of sound is about the same volume as a small radio turned medium-low.

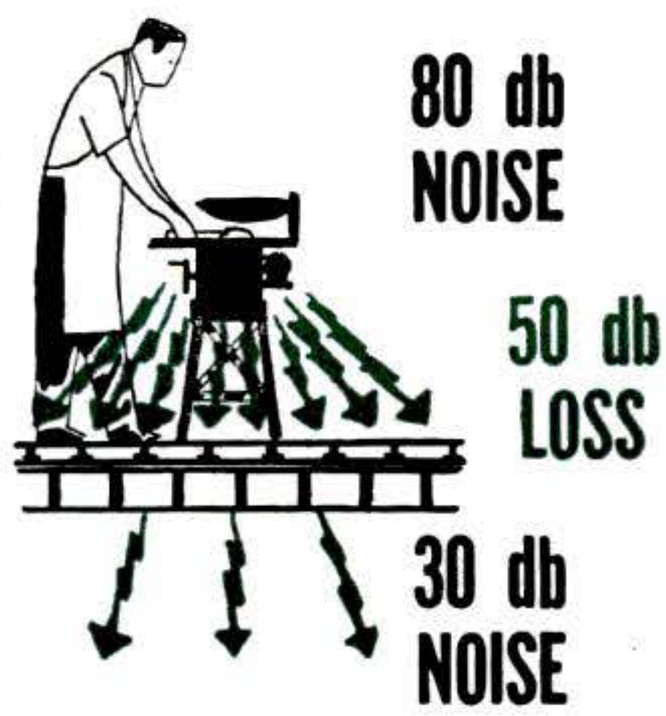


If gypsum board is attached to wood studding with spring clips, the clips "float" the wall with good soundproofing effect. Plaster ½" thick is applied to board.

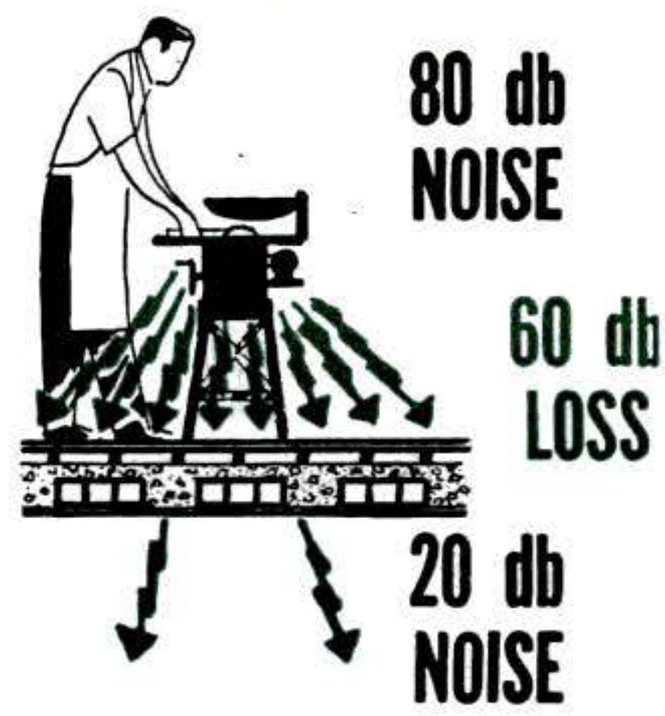
DECIBEL LOSS THROUGH FLOORS



Standard floor, found in most American homes, is formed of 2" x 8" wood joists with subfloor and finished-oak flooring. Not much of a sound insulator.



By floating your oak floor on your subfloor, using Balsam Wool®, a considerable reduction in noise is effected; 1¾" square nailing strips on 16" centers support the oak floor.



Many apartment houses have concrete flooring. Nailing strips, 1" x 2", support the subflooring and oak flooring. This type floor is a good sound insulator.

ple. The second you flip the switch, vibrations travel down the stand and to the floor. From there—if on an upper floor—they spread out through the building.

Frequency of vibration also makes a difference. The natural vibrating frequencies of floors and walls tend to be low. For that reason, it's more difficult to insulate noises of a low pitch. A hum or boom is very persistent in a building.

Besides the vibrations that, say, a power saw sets up directly in the floor, there's also the airborne scream created when you push a piece of wood into the teeth of the blade. This racket spreads in all directions, including the walls and ceiling. Some of the sound passes through, some of it is absorbed, and some of it bounces back. How much passes through, how much is absorbed, and how much bounces back depends on the struc-

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ture. The accompanying sketches show sound transmission through various types of wall and floor construction.

Vibrations. The first thing to do is to stop the main cause of noise—vibrations that are escaping through the floor if the shop is on an upper floor. The best and most efficient way to do this is with a floating platform. This kind of platform is separated from the floor by layers of felt that absorb vibration. Insulating batts between the joists of the platform further dampen noise.

The area of the platform naturally depends on the size of the tool to be mounted on it, but since tripping can be dangerous in the shop, either make it big enough so you can stand on it to operate the tool, or just big enough to take the pedestal.

Building a platform. The base of the platform consists of two layers of 3″ by 3″ strips assembled at right angles to each other as shown on the first two pages of this article. Each 3″ by 3″ strip fits tightly in U brackets that are lined with layers of felt padding. No bolts or other fastenings are used between the two levels of the 3″ by 3″ pieces. Insulating batts are laid on the floor between the joists of the lower layer.

The top of the platform is nailed to the upper layer of joists. Thickness of the top, of course, depends on the weight of the machine. For the average home-workshop tool, ½″ plywood will do since the three-by-threes are spaced 8″ o.c.

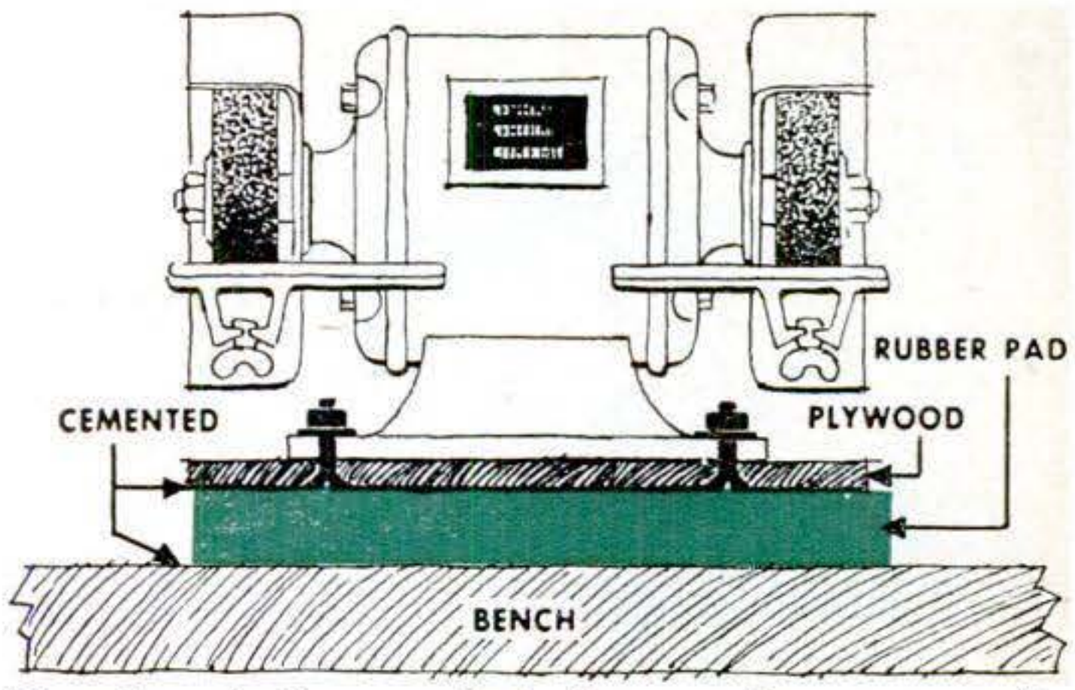
The platform top should overhang the joists enough to allow room for the dust apron. As the drawing shows, the two sections of the apron do not touch each other. They are separated by two strips of insulating batting, one glued to each part of the apron. The lower part of the apron is bolted to the floor; the upper part is nailed or screwed to the top of the platform. The apron is designed to keep shavings or sawdust from accumulating under the platform.

Airborne noises. The handiest way to deaden noises in your workshop is to cover the ceiling and walls with acoustical panels. Panels for the ceiling are 12″ by 12″. Those for the wall are available in either 12″ by 24″ or 24″ by 24″ sizes.

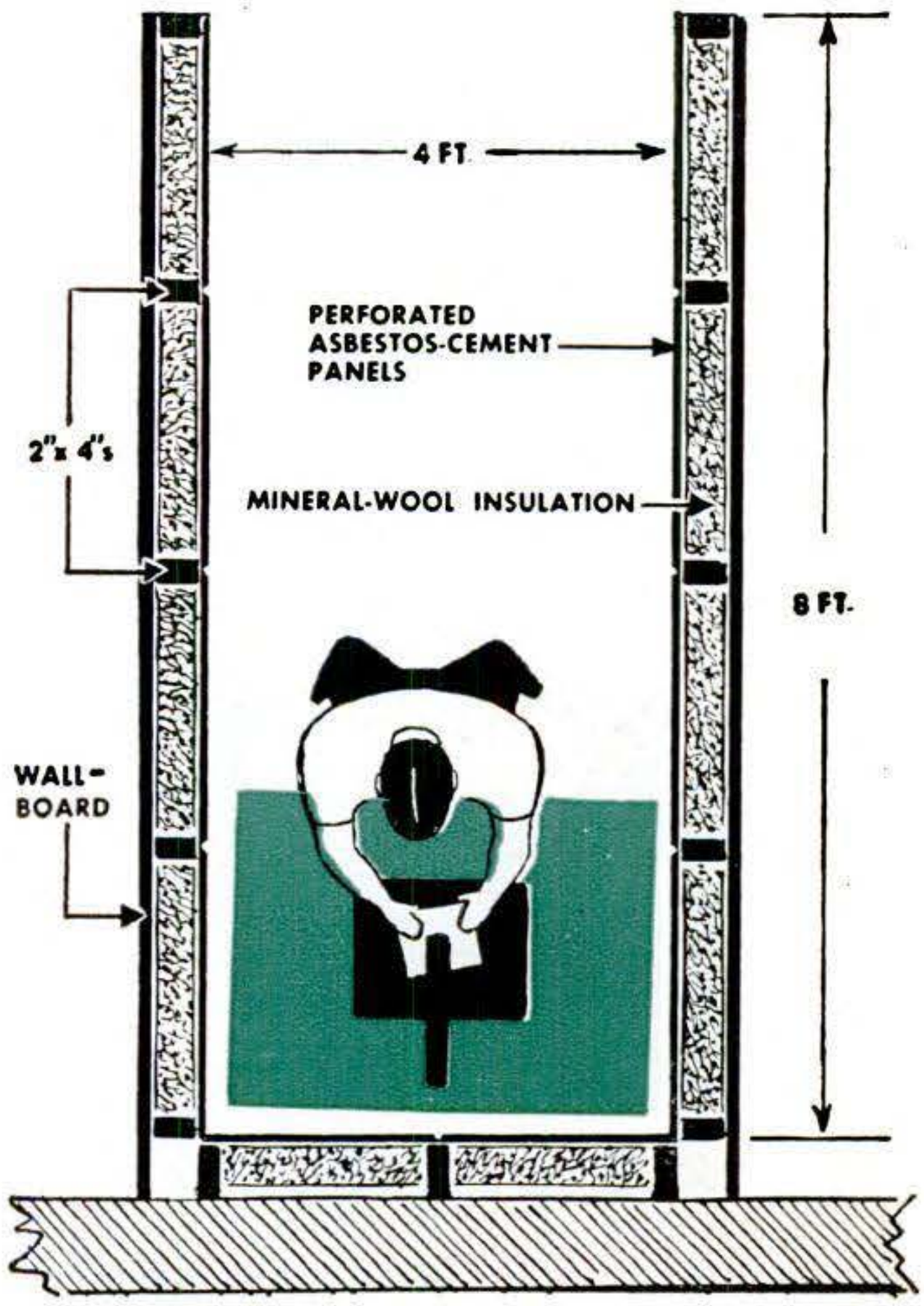
Some ceiling tiles are factory finished with two coats of white paint. Asbestos-cement wall panels are a natural light gray. Whether ceiling and wall panels can be painted without affecting their sound-absorbing qualities depends on the type you use.

Putting acoustical panels on the walls and ceiling of your shop—if it's on an upper floor—will not stop all the noise from leaving the room. But such panels will help. How much depends on the construction of the walls.

If you don't want to insulate the entire room, the three-walled booth shown on this page is an alternate method. The booth, plus a floating platform, will cut down some noise. The booth walls should be ceiling high and the ceiling insulated, too. END



Bench grinders and similar small power tools can be vibration-insulated by mounting them on sponge rubber. Bolt machine to plywood and cement rubber to both plywood and bench



Acoustical booth helps keep noises within bounds. Side walls should be at least twice as long as the back wall. Long walls act as trap to stop most of noise before it reaches open end.

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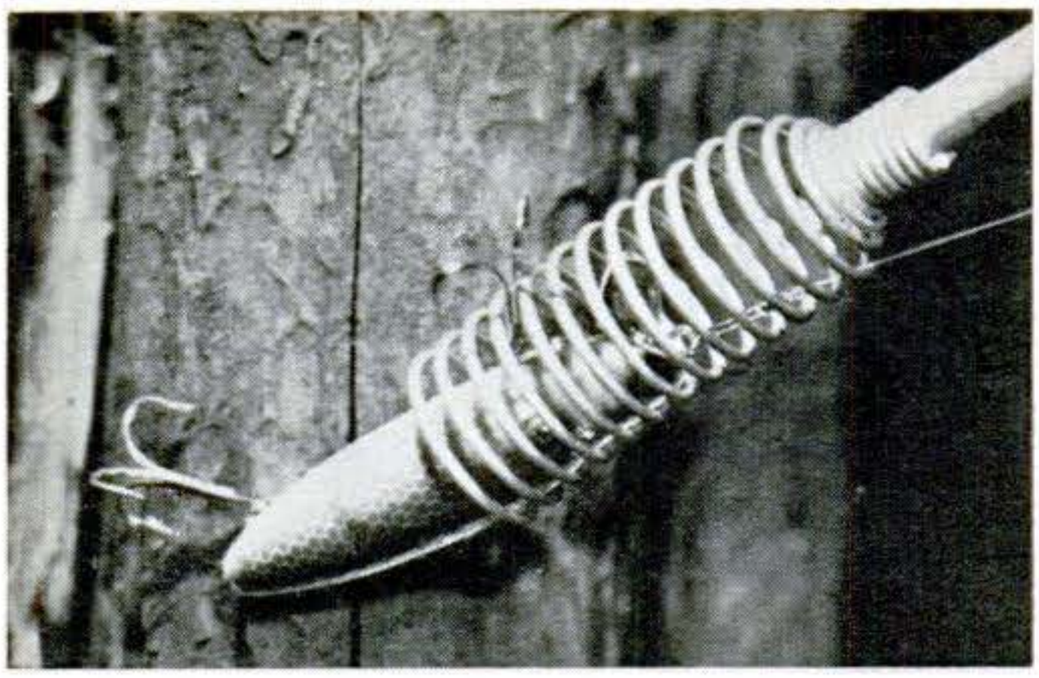
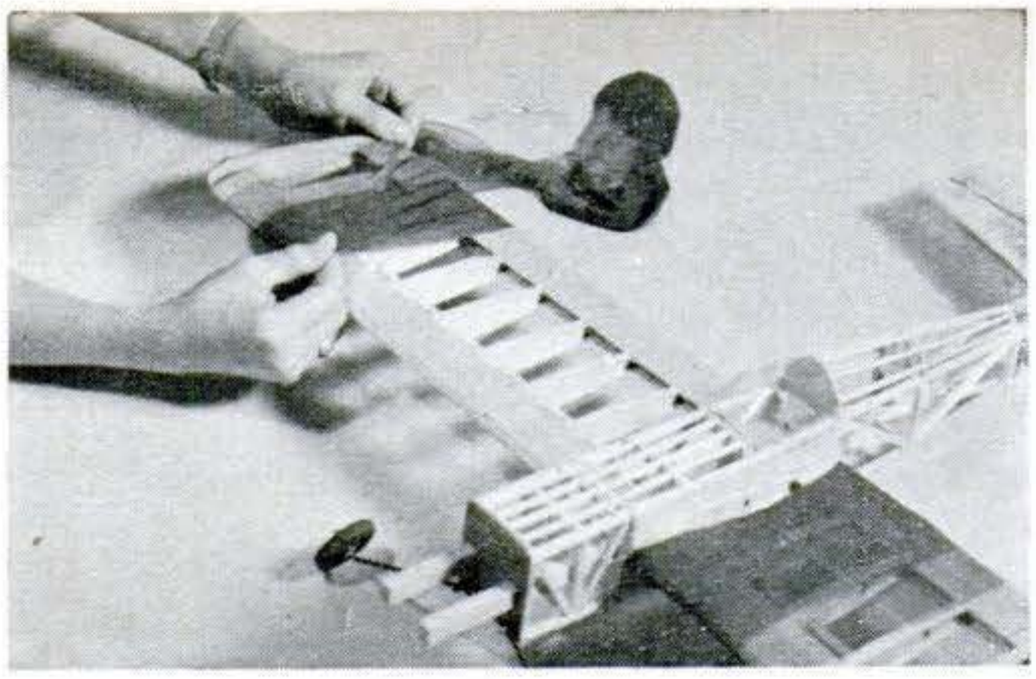


Retrieves Snagged Plugs

FISHING plugs snagged under water can be freed with the Pluget®. The open end of the 1¼″ diameter coil spring is hooked over the line and shoved down to the plug by the 6′6″ handle. The spring engages the plug so you can push, pull, or jiggle it loose. Closed, the handle is 3′6″ long. Norton Products Co., Ft. Worth, Tex., prices the retriever at about $2.



Nylon Reinforces Plane Wings

DISCARDED nylon stockings can strengthen the wings of your model plane. After the framework is finished, stretch a stocking over the wing and glue the ends and edges neatly. Brush the nylon with dope; then paper the wing in the usual way. The nylon acts as a support or reinforcement for the paper, giving it greater resistance to punctures and tears.—*Benj. Nielsen, Aurora, Neb.*

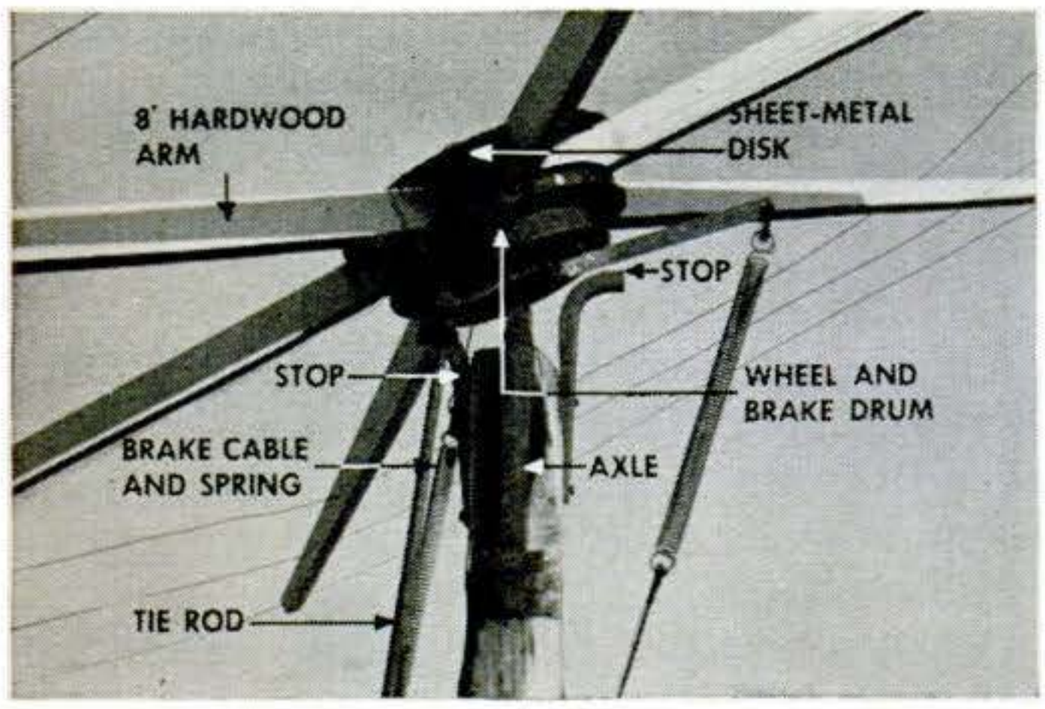
Family Wash Hangs High on Junked Auto Parts

Housewife stands in one spot to hang up or to take down clothes, revolving the reel as she goes along. When heavy clothes are on the upper side, she can keep reel from turning by setting brake.

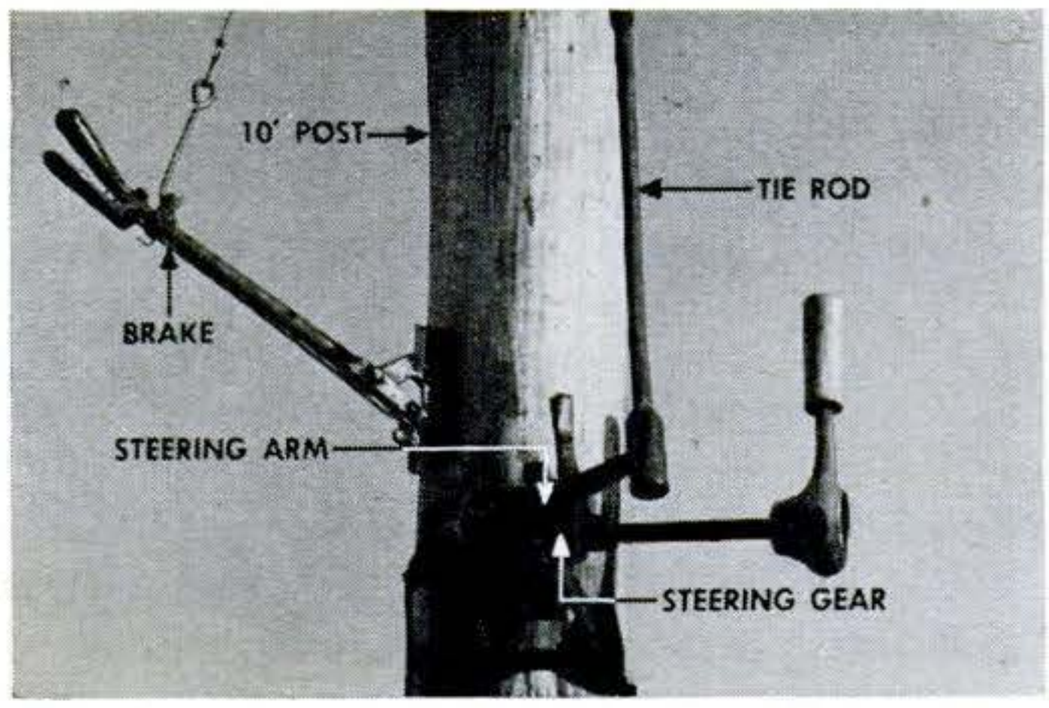
IN W. W. AYRES' back yard at Crescent City, Calif., old auto parts help dry the family laundry.

A front wheel serves as the hub of a 16′ clothesline reel mounted atop a sturdy 8′ post. The wheel, free to revolve, is bolted to the post by its sawed-off axle. A steering assembly dips down one side of the reel so the housewife can reach the lines. Raised to a horizontal position, the reel carries the laundry out of the way.

The six reel arms are bolted to the wheel rim, with a heavy metal disk bolted on top to clamp them tight. The two stops atop the post are old running-board brackets.



Two stops fastened to the post keep the reel from dipping too far in either direction. The spring at right makes it easier to raise the reel to the horizontal position after it's loaded.



Steering gear is bolted to post. To visualize how it raises and lowers the reel, imagine a car resting on its side. The handle is a cut-down steering wheel. Lever at left sets brake.

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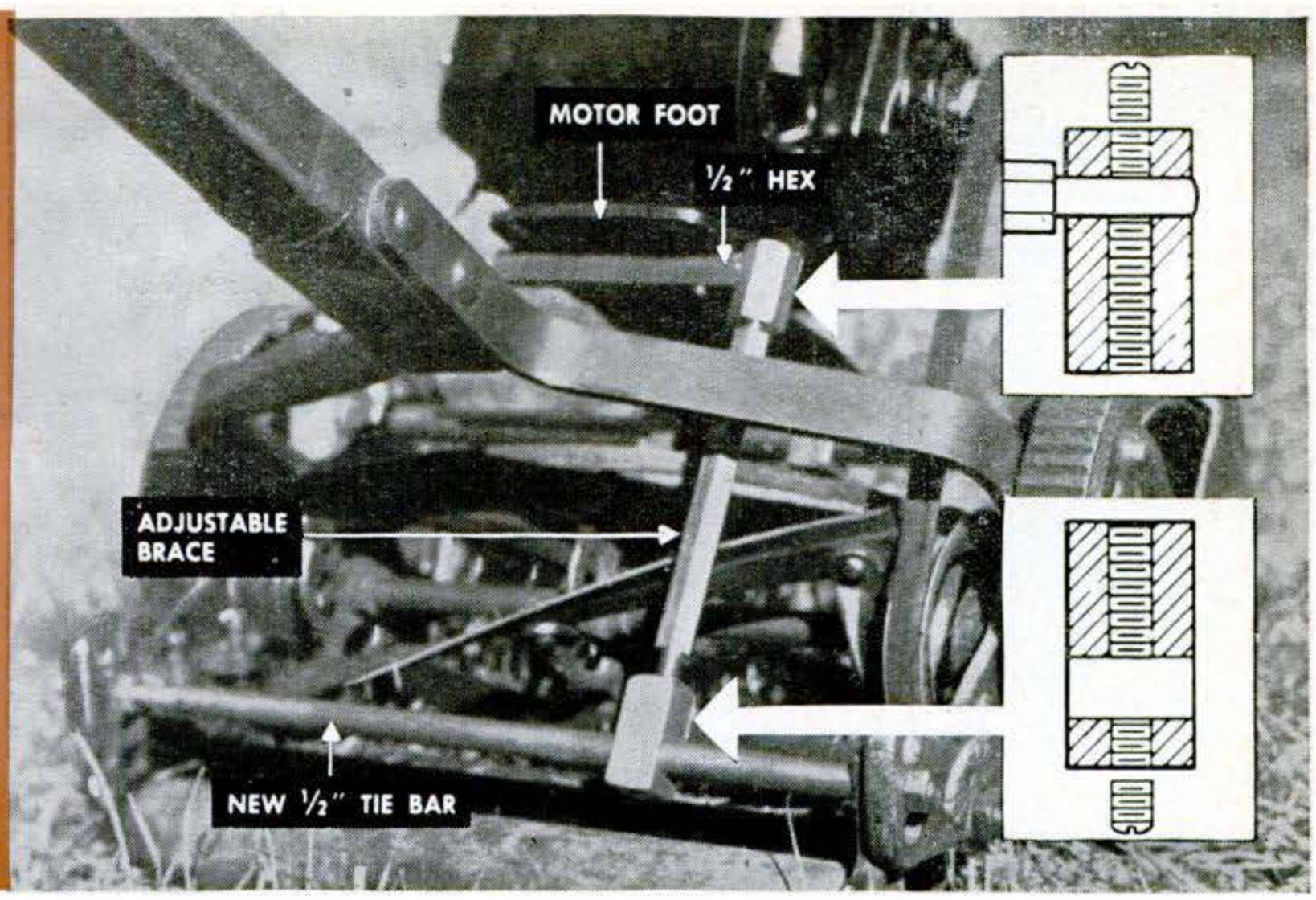
Electric Shaver for Your Lawn



IT'S HARD to work up a sweat with this mower, but mighty easy to trim your lawn. With a motor spinning the cutting reel, pushing the mower where the grass grows greenest is as easy as taking a stroll.

The electric motor is pivot-mounted on the front tie bar. An adjustable brace fastened to a new tie bar between the roller brackets also supports the motor and controls belt tension.

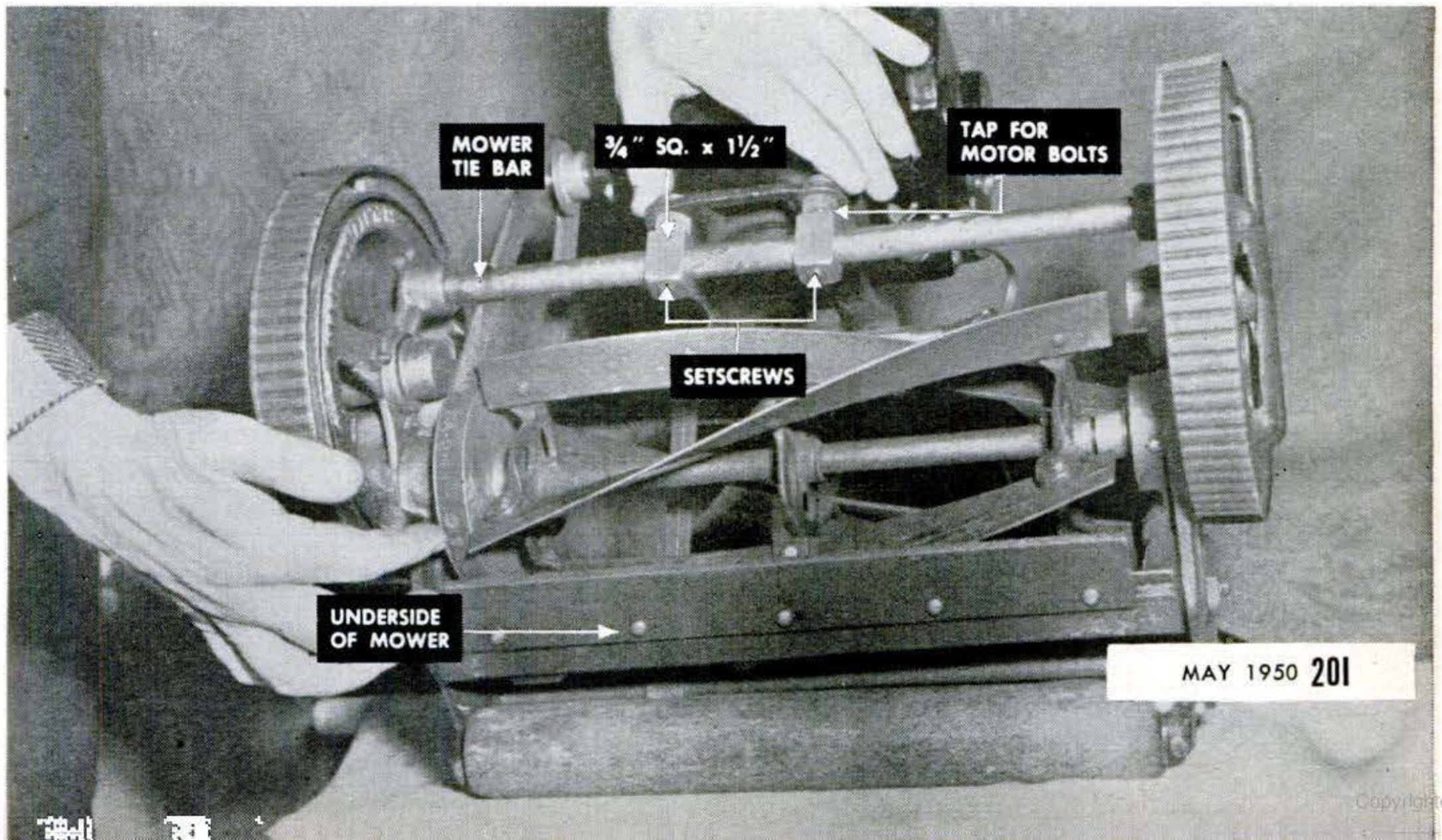
Remove the mower wheels and take out the pinions and ratchet dogs that normally drive the reel. Grind the blades a bit short at one end, if necessary, to make room for a 4½" or 5" V pulley. This may have to be counterbored to fit over the hub of the reel spider. Drill a dimple for the pulley setscrew.

Make the new tie bar for use between the roller brackets out of ½" steel rod threaded at both ends. Drill a block of ¾" square or hex stock to slip on the bar, tap it for a setscrew, and opposite the setscrew tap it ⅜"-16 for about an inch. This will hold the lower end of the brace.

Mount the front edge of the motor on two similar blocks on the front tie bar of the mower. Shoulder down one end of a bar, tap for hold-down bolts, and fasten this across the rear motor mounting holes. A block like the one on the lower tie bar slips on the shouldered end. The brace, made by threading both ends of a length of ½" stock, goes between the two blocks.

To adjust the belt tension, this brace is slipped off one block, turned in or out, and put back. If you can make left-hand threads, put them on one end of the brace and in one block, and you can adjust tension by turning the brace without removing it.

A ¼-hp. motor driving the 1½" pulley gives a reel speed of about 600 r.p.m. A heavy duty electrical cord 75′ long is taped along the handle shaft.—*George P. Metesky, Waterbury, Conn.*



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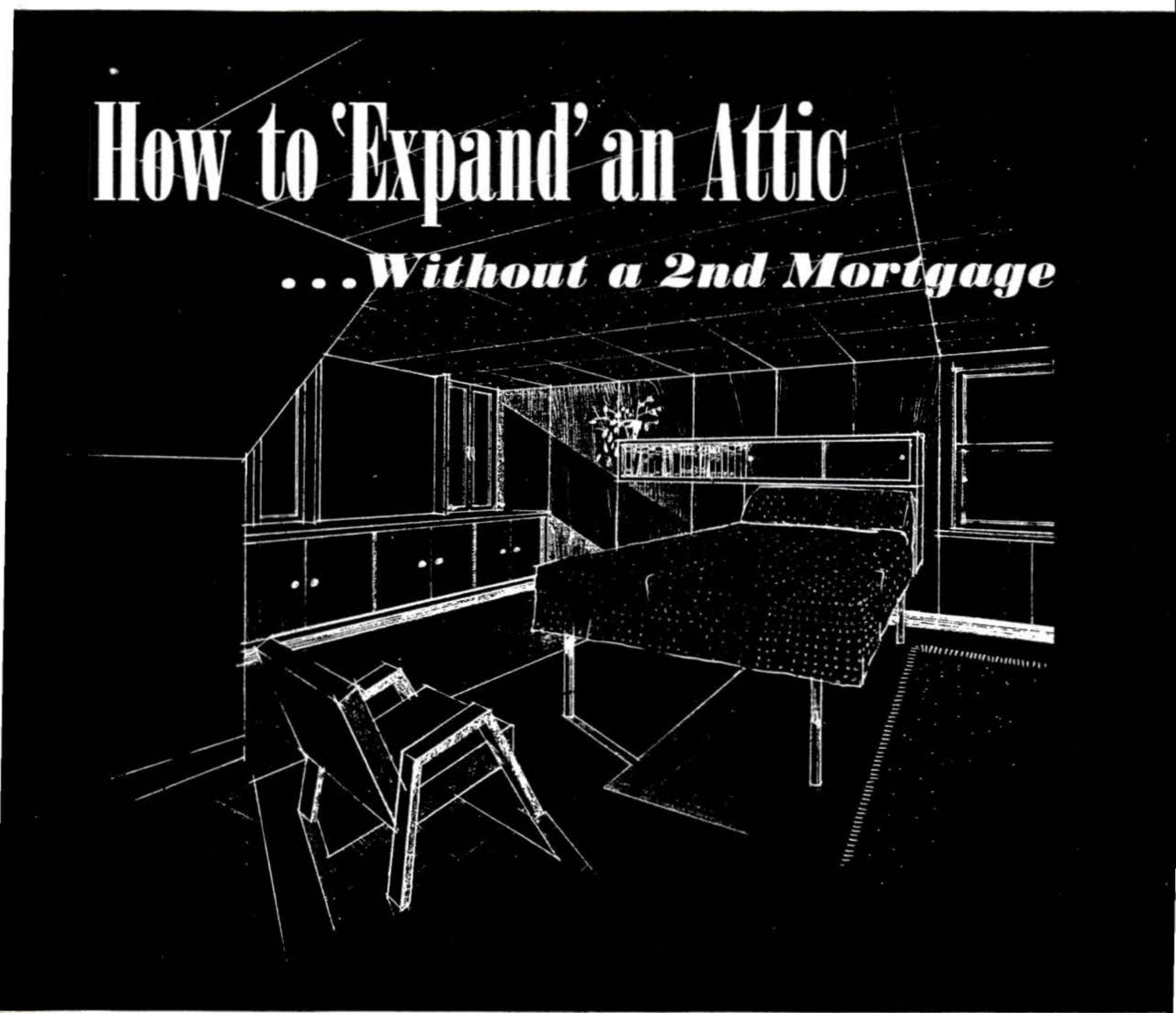
How to 'Expand' an Attic

...Without a 2nd Mortgage



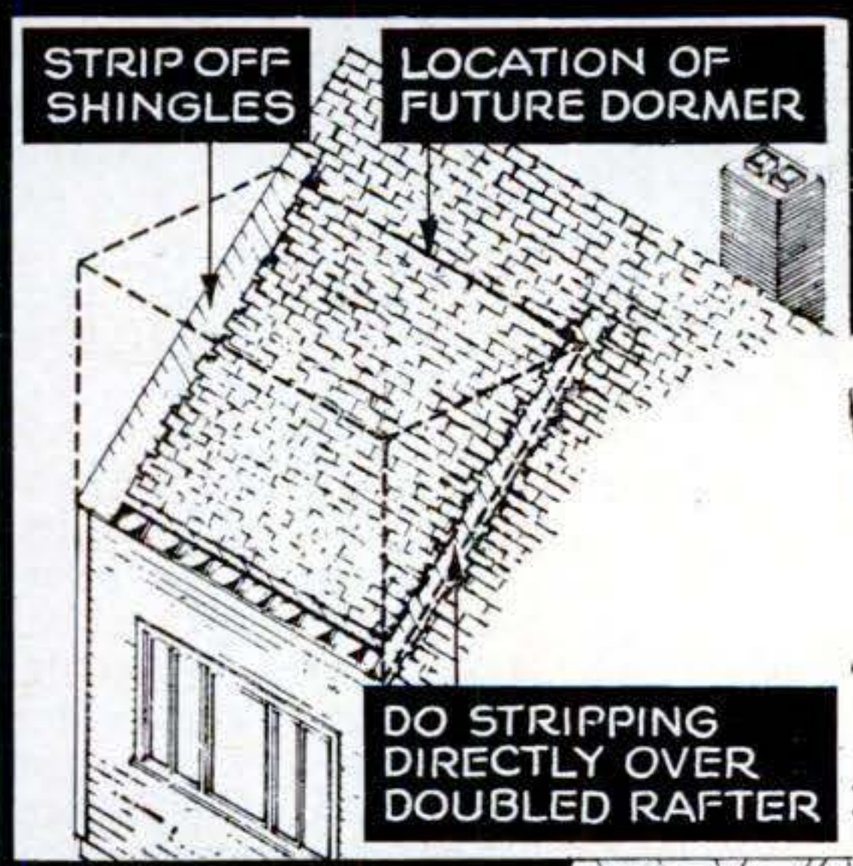
By J. Conrad Breiby, Jr. *Architect*

DOES your home have what the real-estate agents glibly call an "expansion attic"? Poorly lighted and ventilated by undersized windows at each end? Adding a peaked-roof dormer to put an extra bedroom, den, or playroom into that attic space is likely to be difficult and expensive. But the flat-roof type shown here can be built by any reasonably good and careful amateur carpenter.

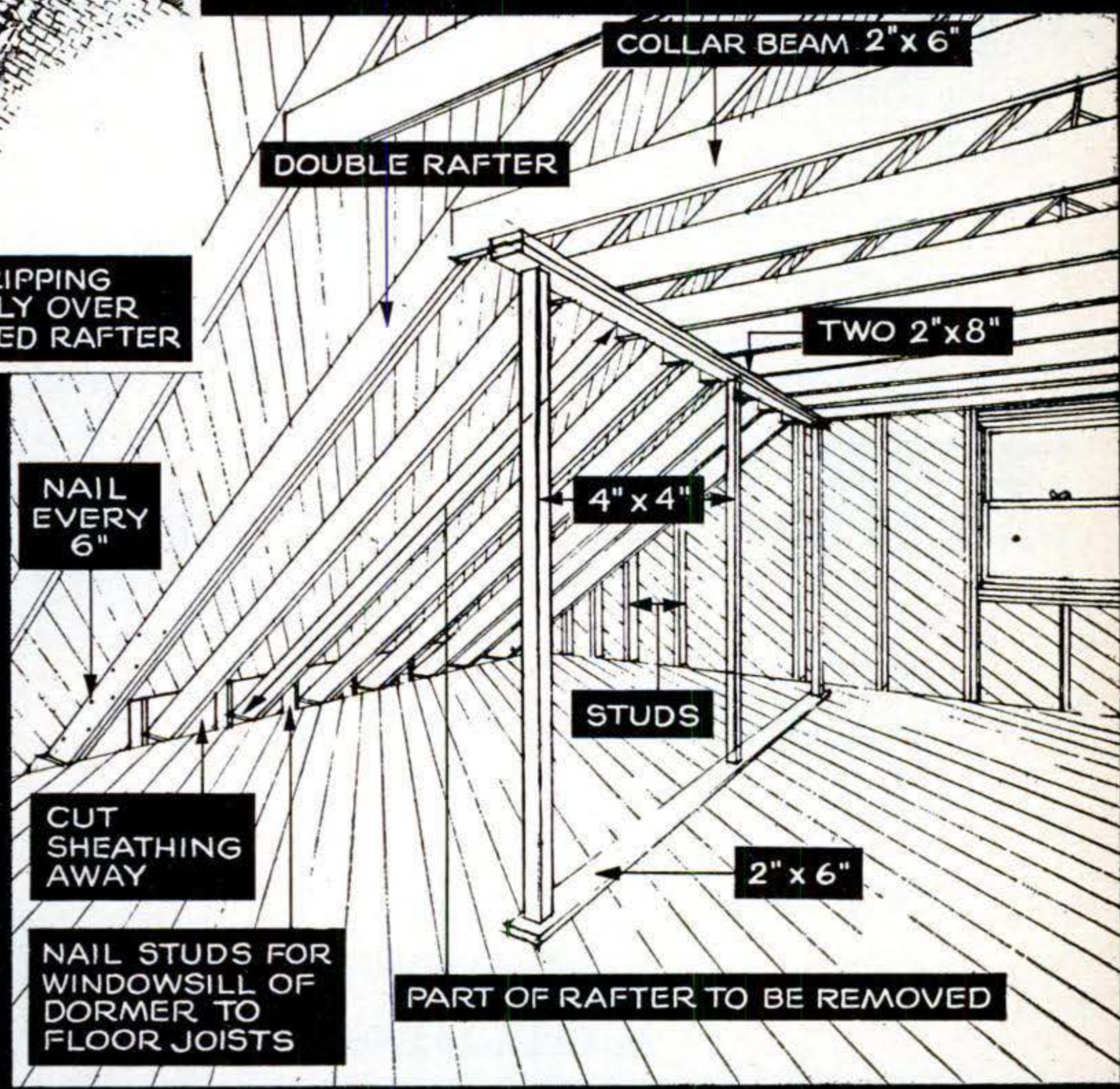
Building a flat-roofed dormer doesn't involve any tricky framing jobs where the window meets the existing roof, and built-up roofing is just about as easy to apply as shingles. Just follow the manufacturer's directions.

You'll get lots more light and headroom, too, from the flat-roof type. You can build the window as wide as you want it—even the full length of the attic. And you can do it without opening the entire roof to the weather while you're building. The only roof openings you need cut while you're building the dormer frame are some small ones—where the windowsill studs meet the joists of the attic floor. And these can be covered with a tarp if you run into a stretch of bad weather.

If your attic doesn't have collar beams—some houses don't—put them in. Nail them to the rafters at a minimum height of 7'6" above the attic floor. You'll need collar beams, anyway, to support the finished ceiling of your new attic room.



1 Rafters usually are spaced 12", 16", or 24" on centers. Decide how large you want your window. Count off the number of rafters in the attic that will give you the desired length. Lay out this distance on the roof, left.



2 This shows temporary support in attic, right. Note doubled rafter. It supports one end of the dormer. Other end is supported by studs. If dormer does not start at one end of house, nail double rafters under both ends of dormer. If your attic doesn't already have collar beams (horizontal ties), nail them to the rafters at a minimum height of 7′ 6″ above the attic floor.

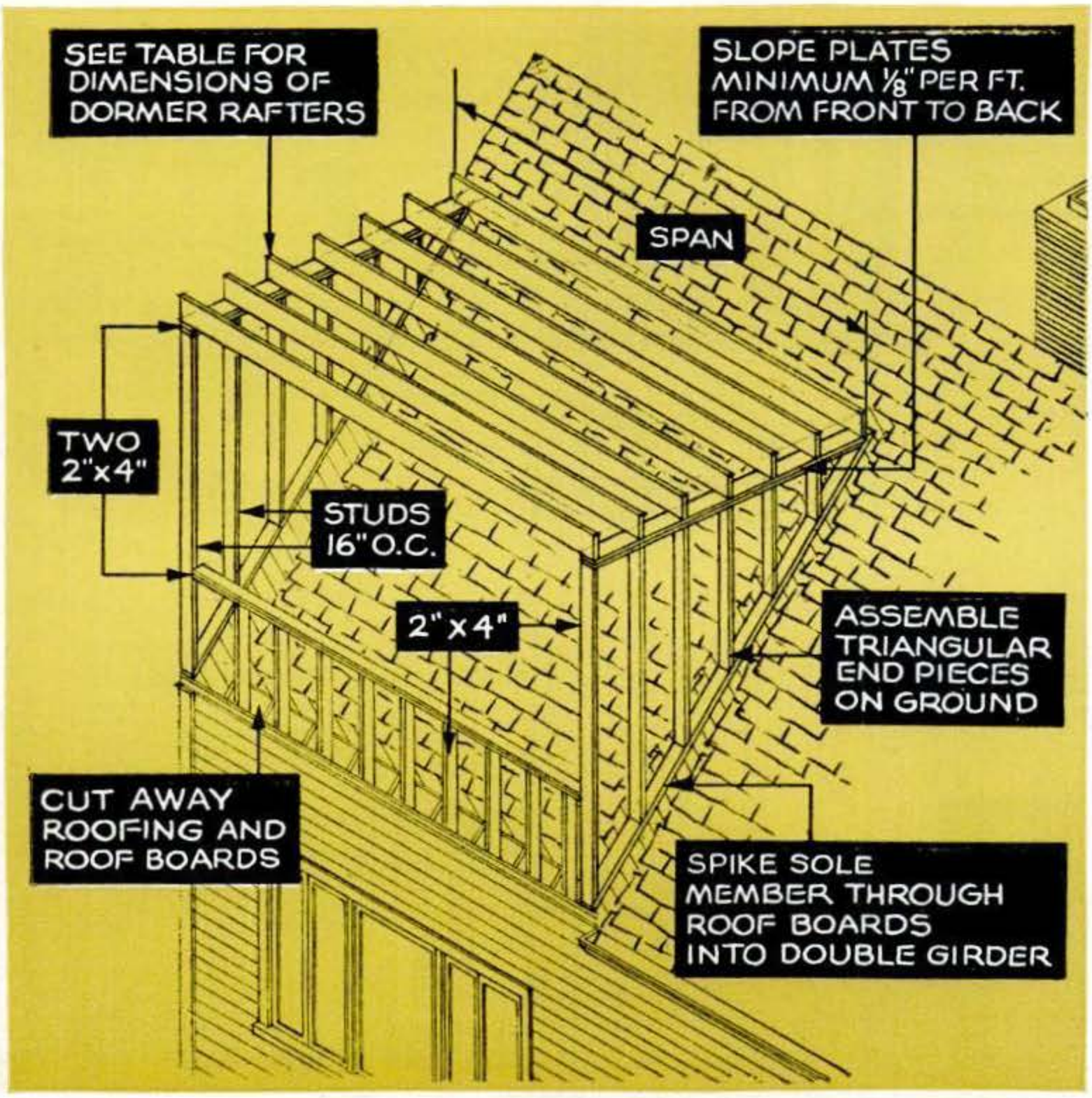
The double rafter (see drawing No. 2) is important. It carries much of the weight of the dormer. Take templates off each end of an existing rafter. Measure an existing rafter. Then lay out the length and templates on the new rafter.

When it's time to remove the old roofing—after you've finished the dormer—drill a hole through a roofing board and start with a keyhole saw. Saw through the boards just inside the double rafter and just inside the sole of the dormer at the other end.

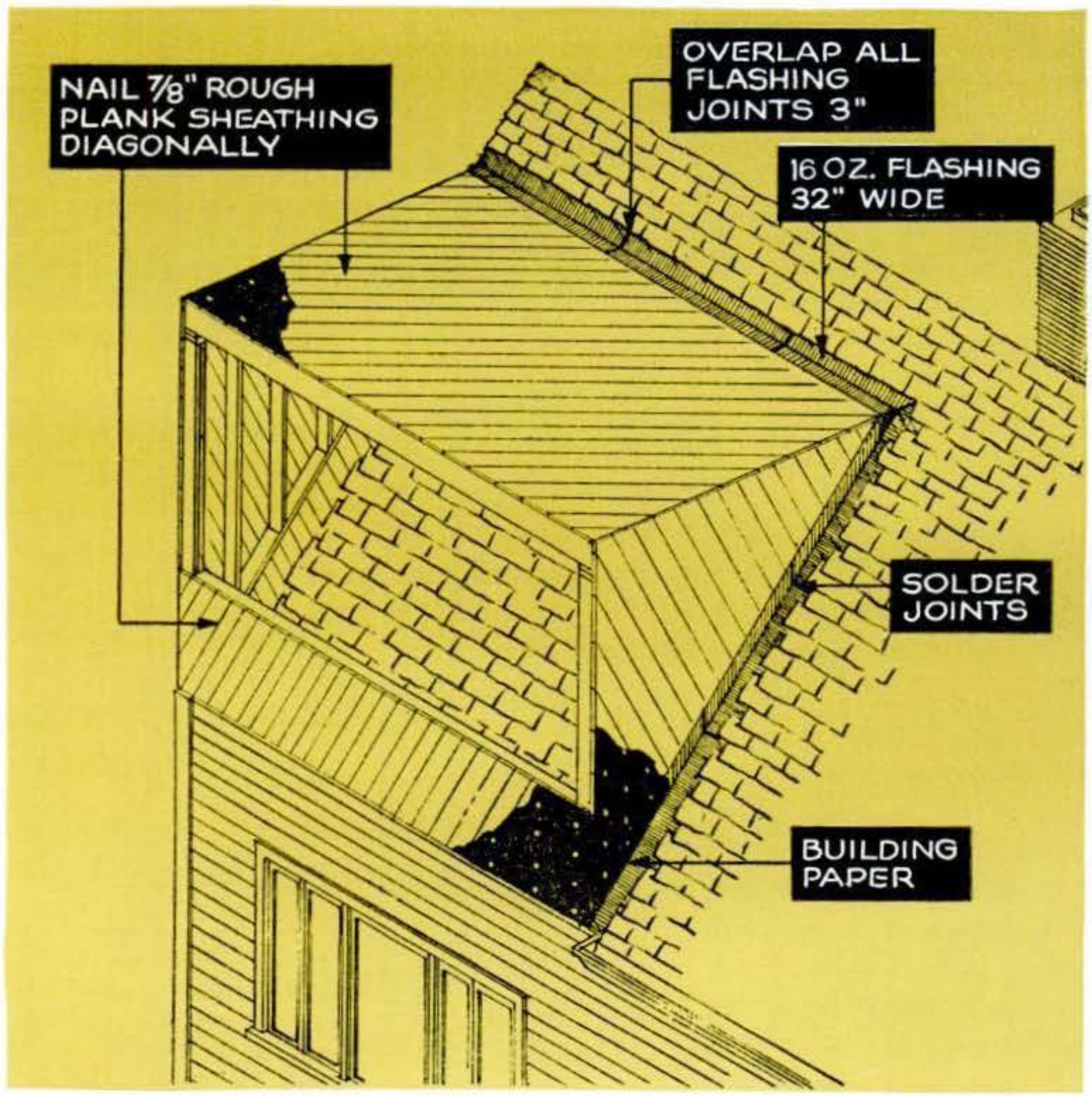
You have a wide choice of window-sash types and arrangements. The dormer pictured here has a fixed pane in the center with casement-type sash at each end. Installation details of the windows vary with the sash you use.

WINDOW SPAN	DISTANCE ON CENTER	RAFTER SIZE	GIRDER SIZE (2 REQ.)
9′0″ 8′0″ 6′0″	12″ 16″ 24″	2″ x 6″	2″ x 6″
12′0″ 10′0″ 8′0″	12″ 16″ 24″	2″ x 8″	2″ x 8″
15′0″ 13′0″ 11′0″	12″ 16″ 24″	2″ x 10″	2′ x 10′
18′0″ 16′0″ 14′0″	12″ 16″ 24″	2″ x 12″	2″ x 12″

Span of window and distance between rafters determines size of rafters and double girder you need. Table gives those dimensions. Example: window with 15′ span needs 2″ by 10″ rafters 12″ o.c. and double 2″ by 10″ girder.



3 Framework of your dormer is shown here. It's made up of two-by-fours except the rafters. Rafter width and thickness depend on their length and the distance they are set on centers. Toenail each rafter to the plates at either end with four 20d spikes. Plates, corner studs, and window sill are doubled two-by-fours. Slope the plates at least ⅛" per foot back toward existing roof for drainage: this eliminates need for new gutter and downspout. Measure along the floor of the attic and up to a collar beam to get the dimensions of the triangular endpieces. Use 16d nails to fasten the studs to soles and to hold the windowsill studs. Use 10d nails to hold plates to studs and soles to roof.



4 This drawing shows the window after sheathing has been nailed to rafters and studs. The sheathing is covered with building paper and the flashing installed. Flashing is applied so 16" of it is covered by shingles and 16" of it by finished siding and the roof. Lap all joints in the flashing 3" and seal them with continuous solder joints. Fasten sheathing to each rafter and stud with two 8d nails.

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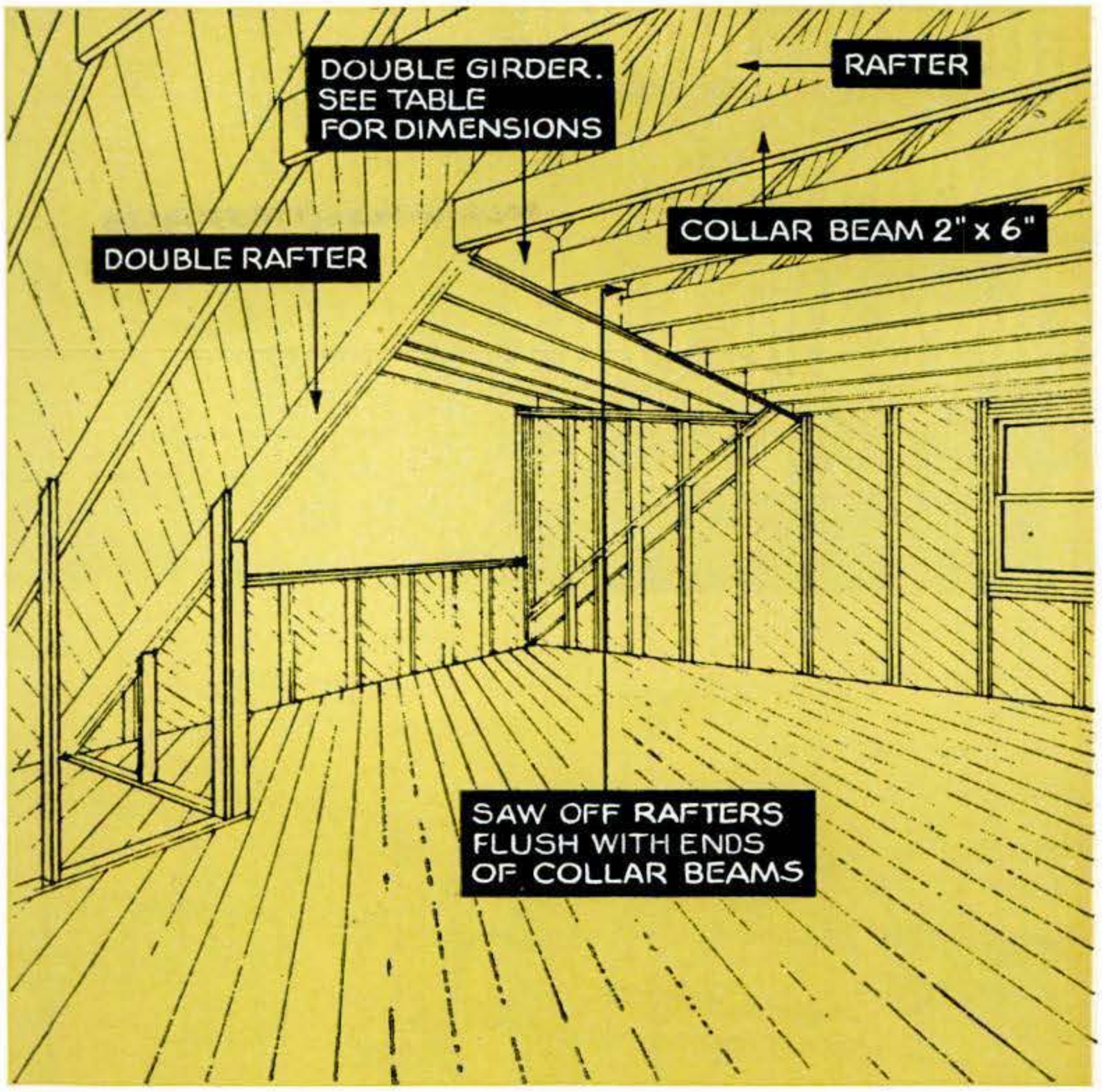
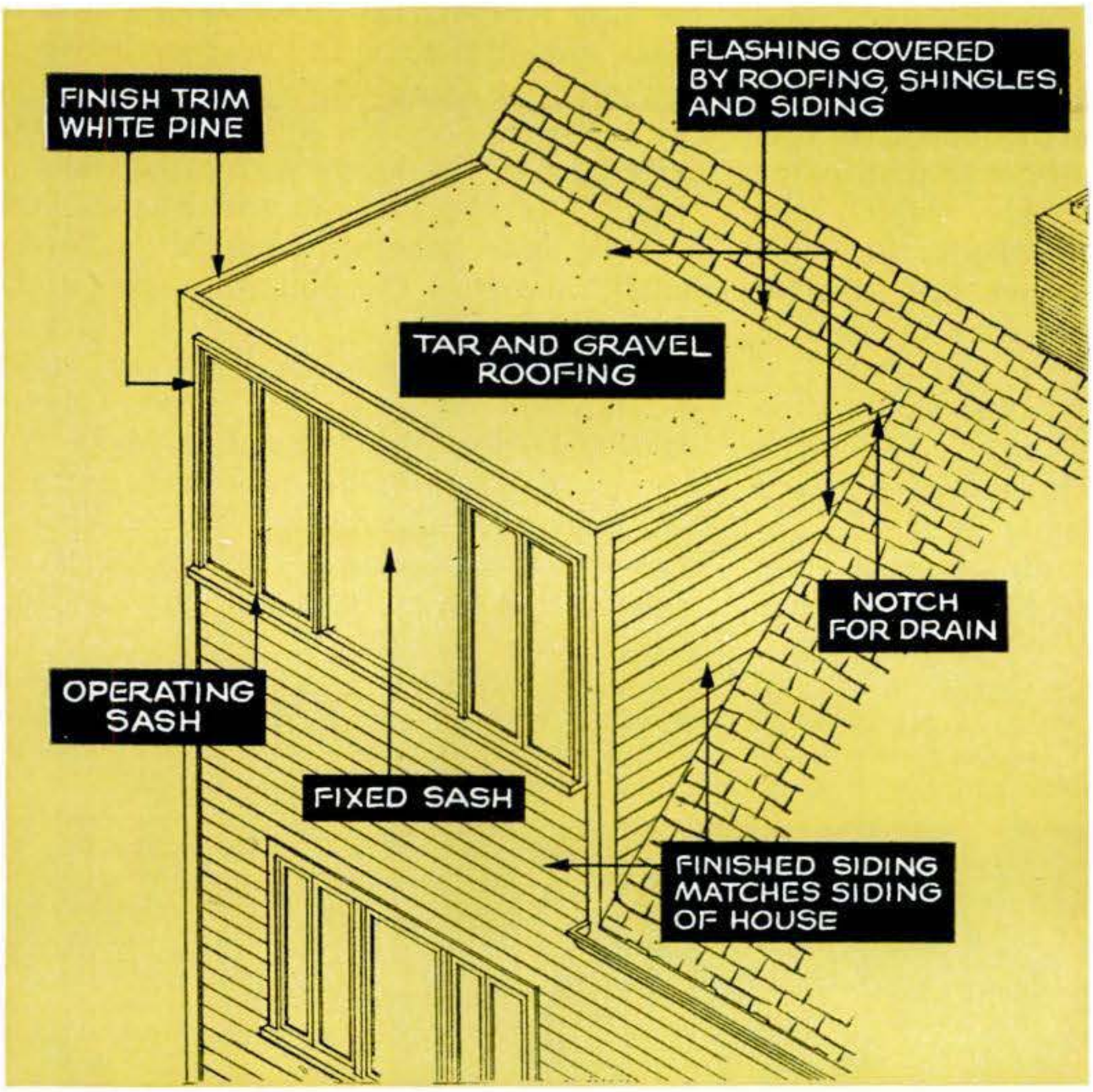
5 **Before removing** the support shown in drawing No. 2, remove old roofing boards by sawing them away. Then saw off the sloping rafters flush with the collar beams and spike double girder to both rafters and collar beams. Toenail ends of existing rafters to double girder and the girder to the double rafter with 16d nails. Now you can remove the support.





6 **Finished siding,** roofing, and finish trim of white pine have been installed. Roofing is the built-up kind—alternating layers of felt and pitch or tar laid according to the manufacturer's instructions. Type of windows and their arrangement is optional. But use stock sash. It's not as expensive as the specially built kind. This drawing shows casement-type sash at each end with a large fixed pane between them. Nail the siding over the sheathing with 6d finishing nails. Use 10d finishing nails to attach the trim to the window.

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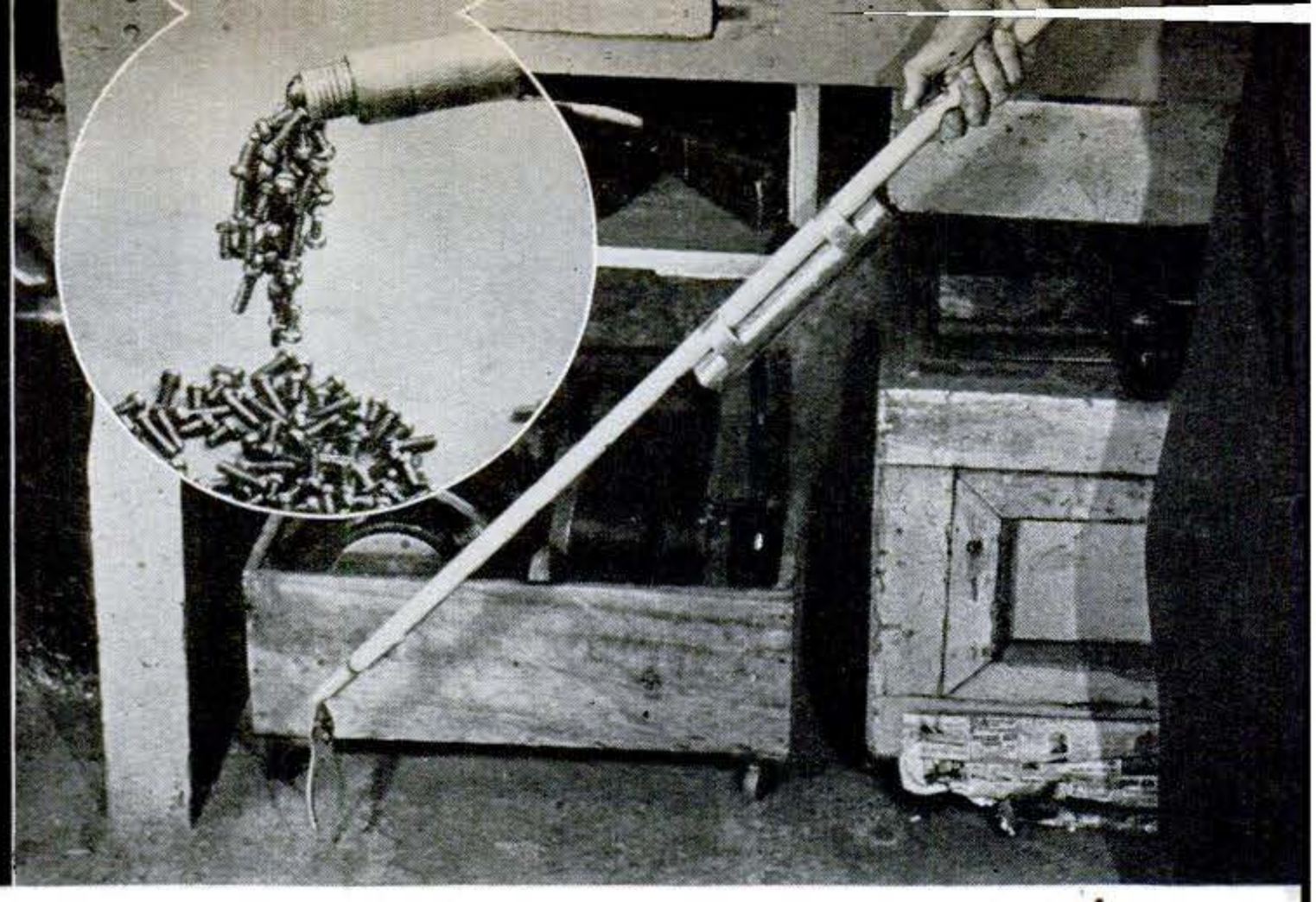
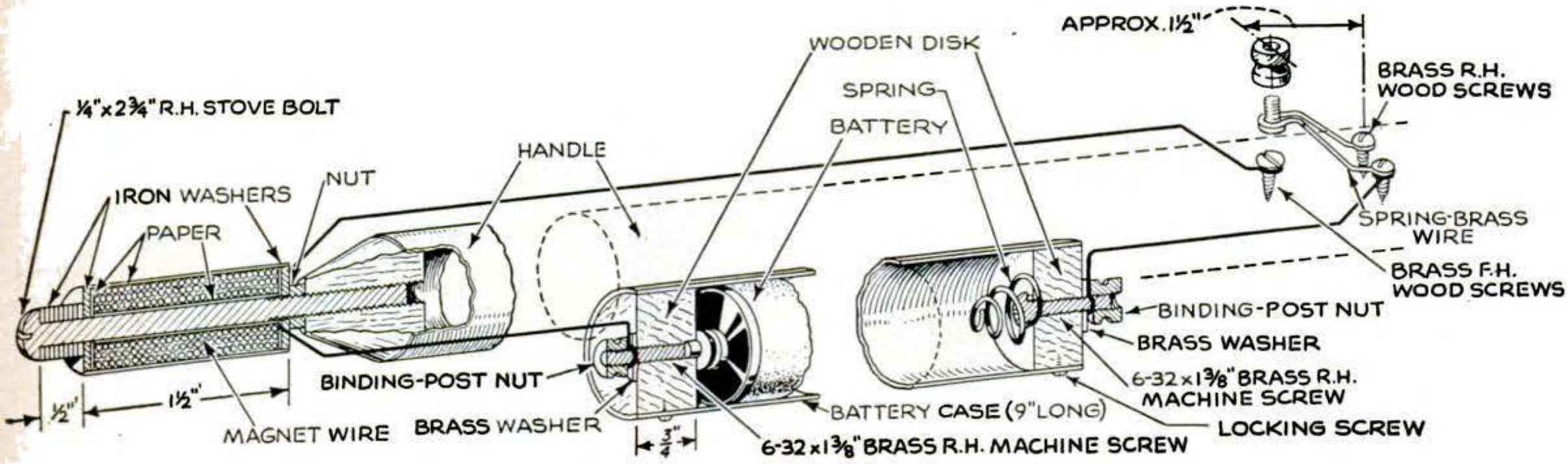
Magnetic Broom Reaches Where You Can't

By Walter E. Burton





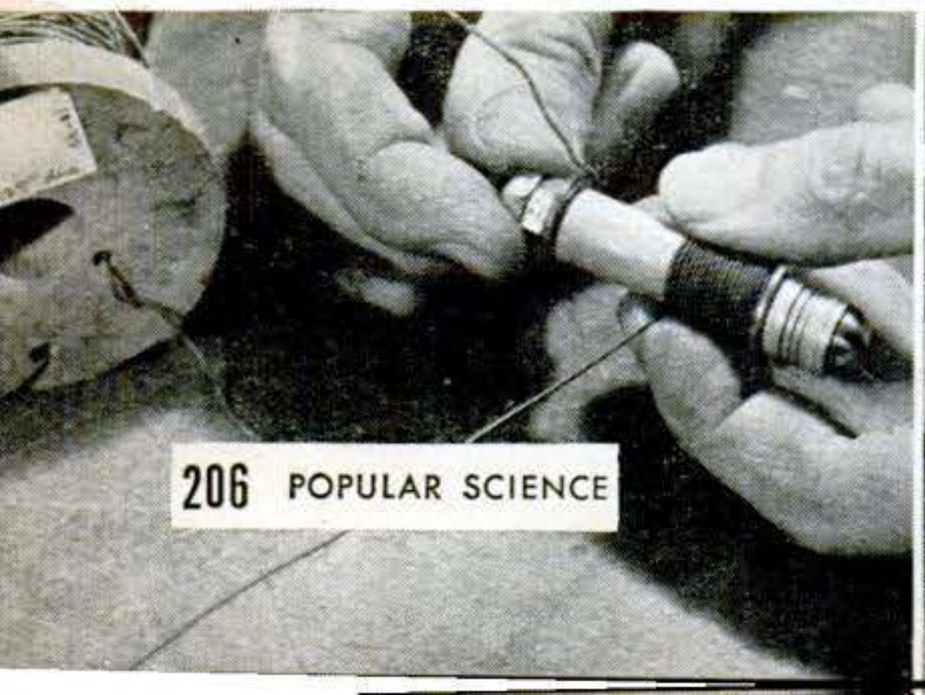
WITH a magnetic broom, you can quickly recover bolts, washers, tools, and other bits of ferrous metal from hard-to-reach places. It can be used, also, to separate iron or steel from nonmagnetic material, and to pick up and carry small parts. This battery-powered model, which can be made in an evening, is better for these jobs than permanent-magnet rigs, since it can be shut off to permit easy removal of filings and scrap.

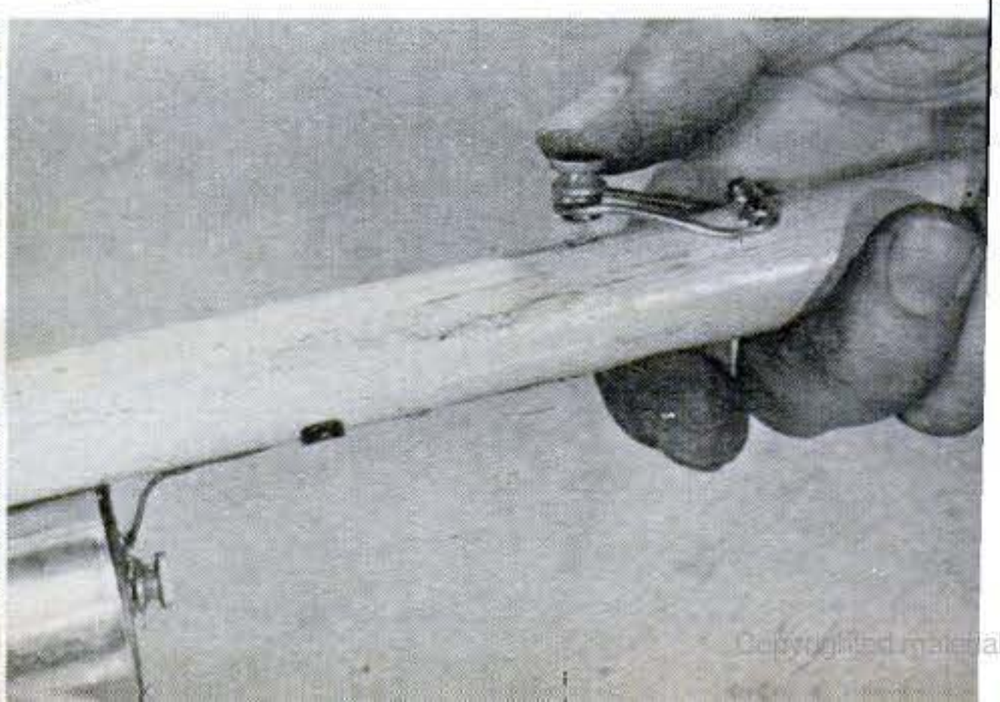
Three or four flashlight cells mounted on a broom handle power an electromagnet fastened to the end. Three cells will last about a year under normal use.

To make the magnet, slip seven or eight small iron washers on a ¼" by 2¾" bolt. Then add two larger washers and a nut. Space the large washers 1½" apart, wrap a layer of paper around the bolt in the space between, and wind the space full of insulated No. 24 magnet wire. Keep the turns even, and separate each of the layers with a thickness of paper. Bind the whole unit with tape. Drill an undersized hole in the end of the broom handle and turn the bolt in as far as the nut will permit.

For the battery case, cut, bend, and solder tin plate to form a 1⅜" by 9" tube. Tape or strap the tube to the handle. Make two wooden plugs to fit the tube ends and use two bolts and a spring for the contacts, as shown in the drawing. These terminals are connected to the coil ends through a switch.

Winding wire on a bolt makes an electromagnet for the broom. Wrap paper between successive layers of wire. Contacts for the flashlight cells consist of bolts running through wooden plugs (center). One of the plugs is provided with a conical spring. The thumb switch is made from wire, screws, and a knurled nut. Almost any switch could be used.





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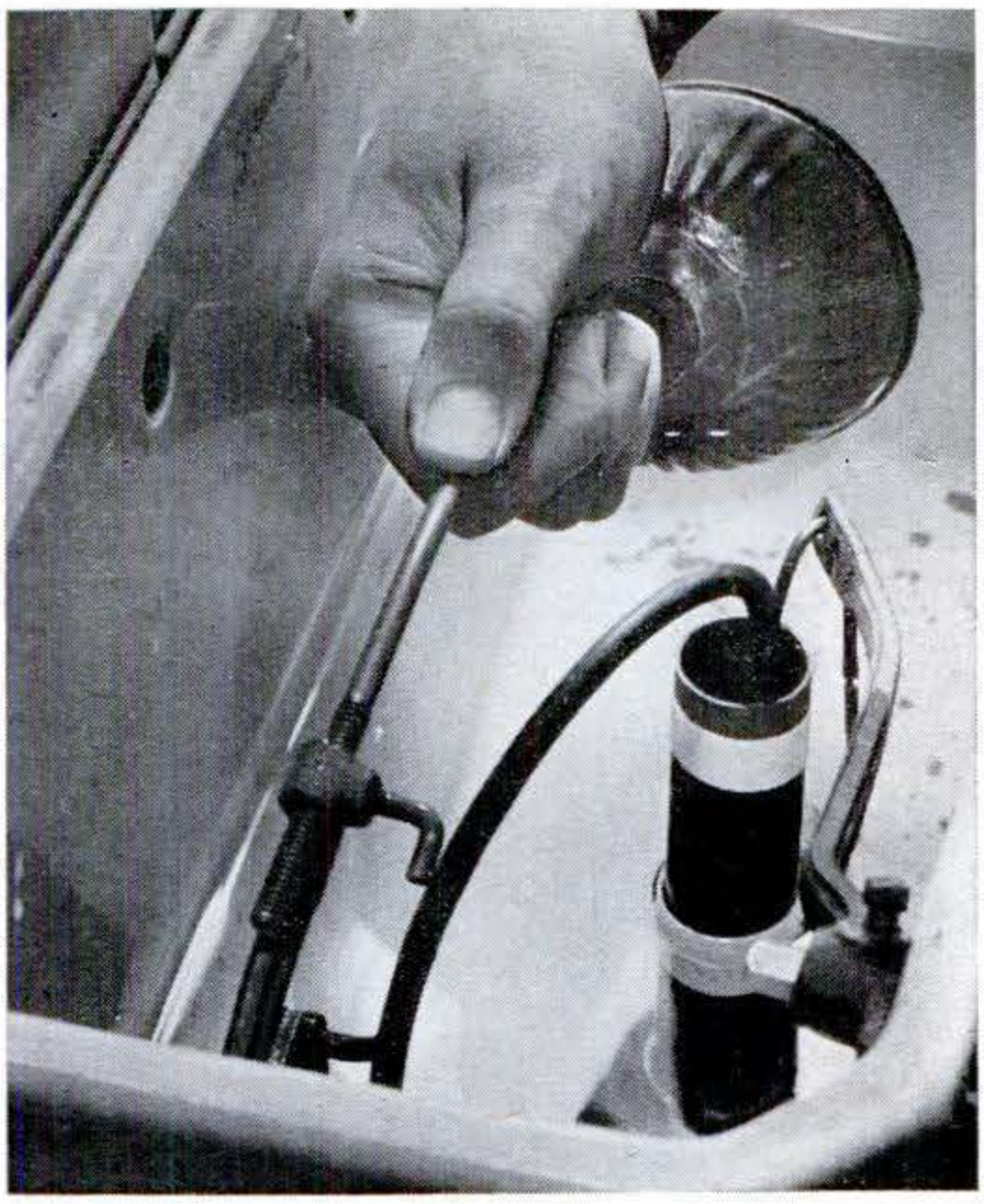
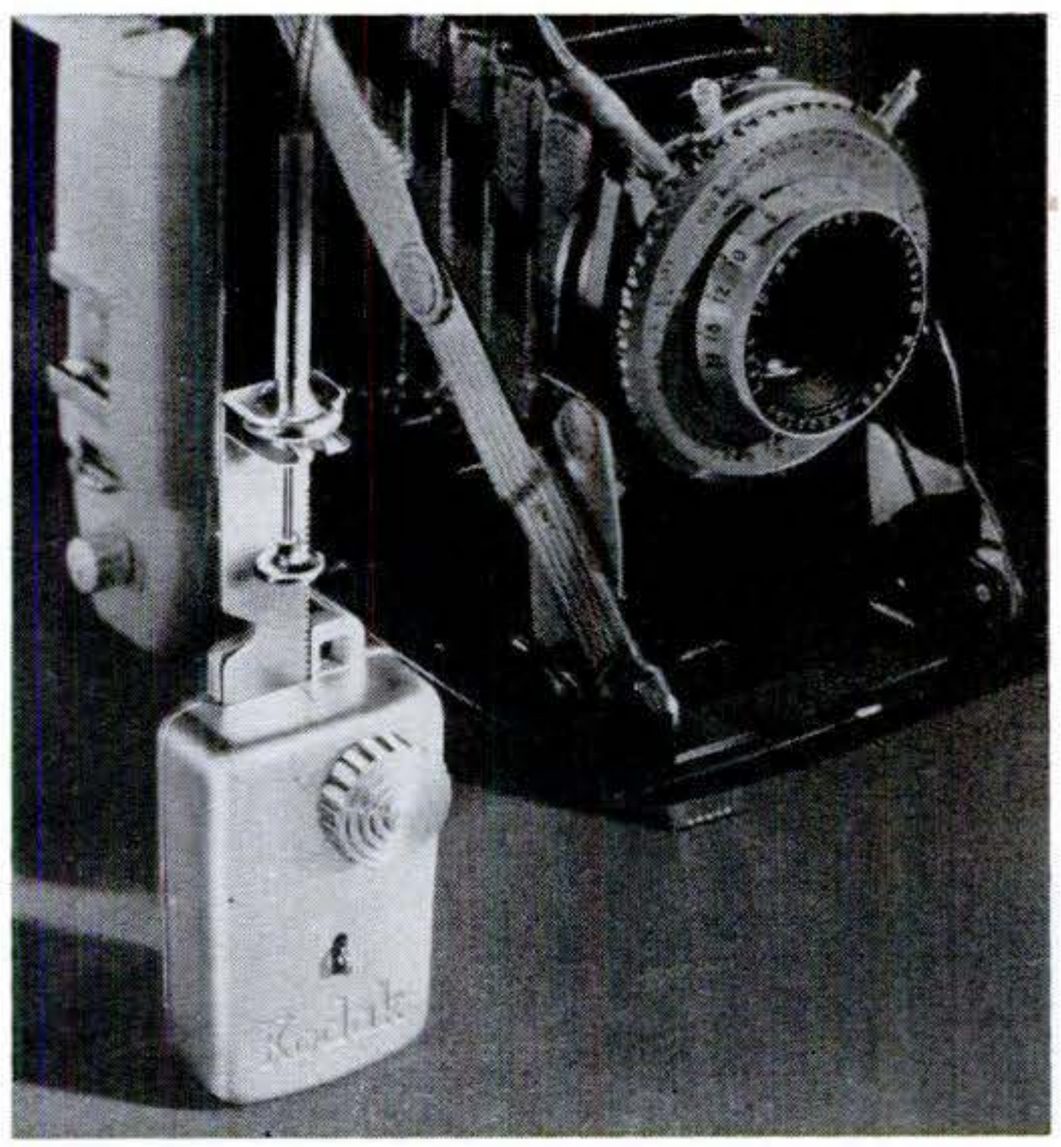


Easy Way to Save Water

BENDING down the rod attached to the float will reduce the amount of water used whenever a tank-type toilet is flushed. Bend the rod as shown in the photo. This depresses the float and shuts off intake of water sooner, so the water level in the tank is lower.

Gears Swing Tripod Head

UNABLE to get smooth panoramic movie shots with commercial camera heads, I designed and built my own (shown here) around two sets of worm gears, each giving a 40 to 1 reduction. For lightness, the head was machined from aluminum alloy. For accuracy, preloaded ball bearings serve as the main support bearings. A small ball bearing in the base takes the thrust load while sets of small needle bearings support the worm-gear shafts.—*Donald B. Terrana, Brooklyn, N. Y.*



You Can Get in Picture Too

A NEW self-tripping shutter release introduced by the Eastman Kodak Company can be adjusted to give varied periods of delay up to about 10 seconds. Called the Kodak Auto Release, it sells for about $4.25.

Knife Trays Hold Slides

Two wooden knife trays, two small hinges, and some scrap wood are all that's needed for this color-slide file chest. Remove the partitions from the tray that forms the lid, and glue in either saw-kerfed sidepieces or thin wood strips to hold the slides. A small flat hook holds the case shut.—*O. H. Marsh, Hammond, Ind.*

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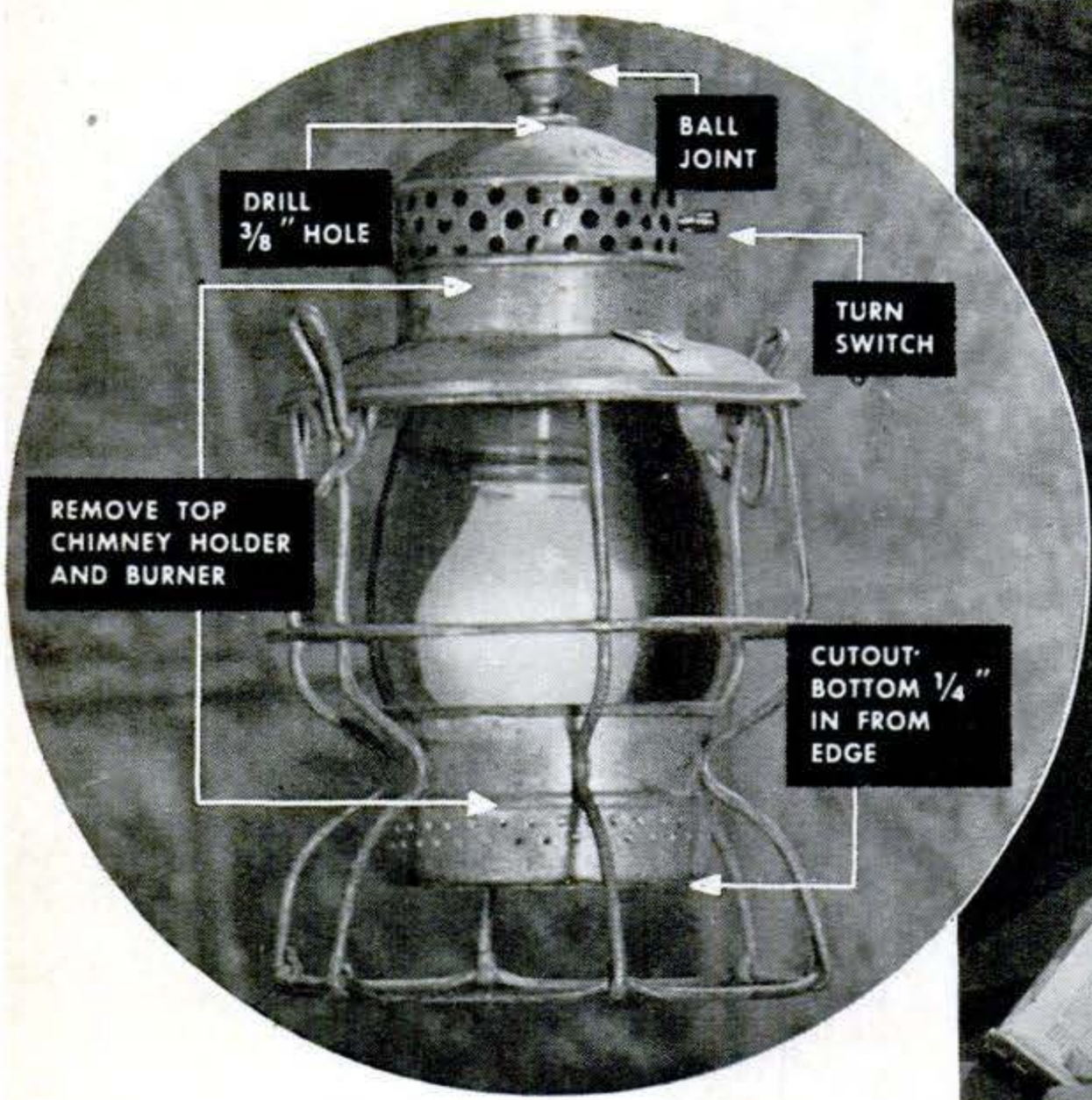

Screwdriver, hacksaw, and drill are the only tools you need to turn an old brakeman's lantern into this unusual bridge lamp.

Old Lantern Makes Rustic Lamp

For a summer cabin or hunting camp, a lamp like this one is more appropriate than one with a frilly shade. I used an old brakeman's lantern and a second-hand bridge-lamp stand. First remove the wick and oil reservoir from the lantern, then cut the bottom out. This opening will let the light shine downward. Next take out the upper shade holder and flues in the top. You'll find there is plenty of room for a socket. You can use a socket with a pull chain or one with a switch button. If the button type is used, unscrew the stem and then put it back through one of the ventilation holes. Use the lantern's glass shade, or substitute a frosted one.—*C. G. Bucher, White Plains, N. Y.*

Thread Sealer Comes in Stick

This stick of thread sealer for making tight pipe joints is designed to be carried easily in either pocket or tool kit. Called Thread-Tite®, it's made by Armite Laboratories, of Los Angeles, Calif. It is said to provide a positive seal against gases, brine, acids, water, steam, and ammonia and can be applied to threads of steel, aluminum, iron, brass, copper, plastic, and any other type of material. The compound also serves as a lubricant, permitting easier coupling of pipes.

Helicopter Walks the Ceiling

Flying straight up is a cinch for this simple toy helicopter that can be put together in half a minute. Made by the A-J Aircraft Co., Portland, Ore., it has two bent-wood propellers, one powered by a rubber band and the other fixed to the stick, that rotate in opposite directions. Released horizontally, the Ceiling Walker® will dart sidewise before climbing. Outdoors, it can fly above the rooftop.

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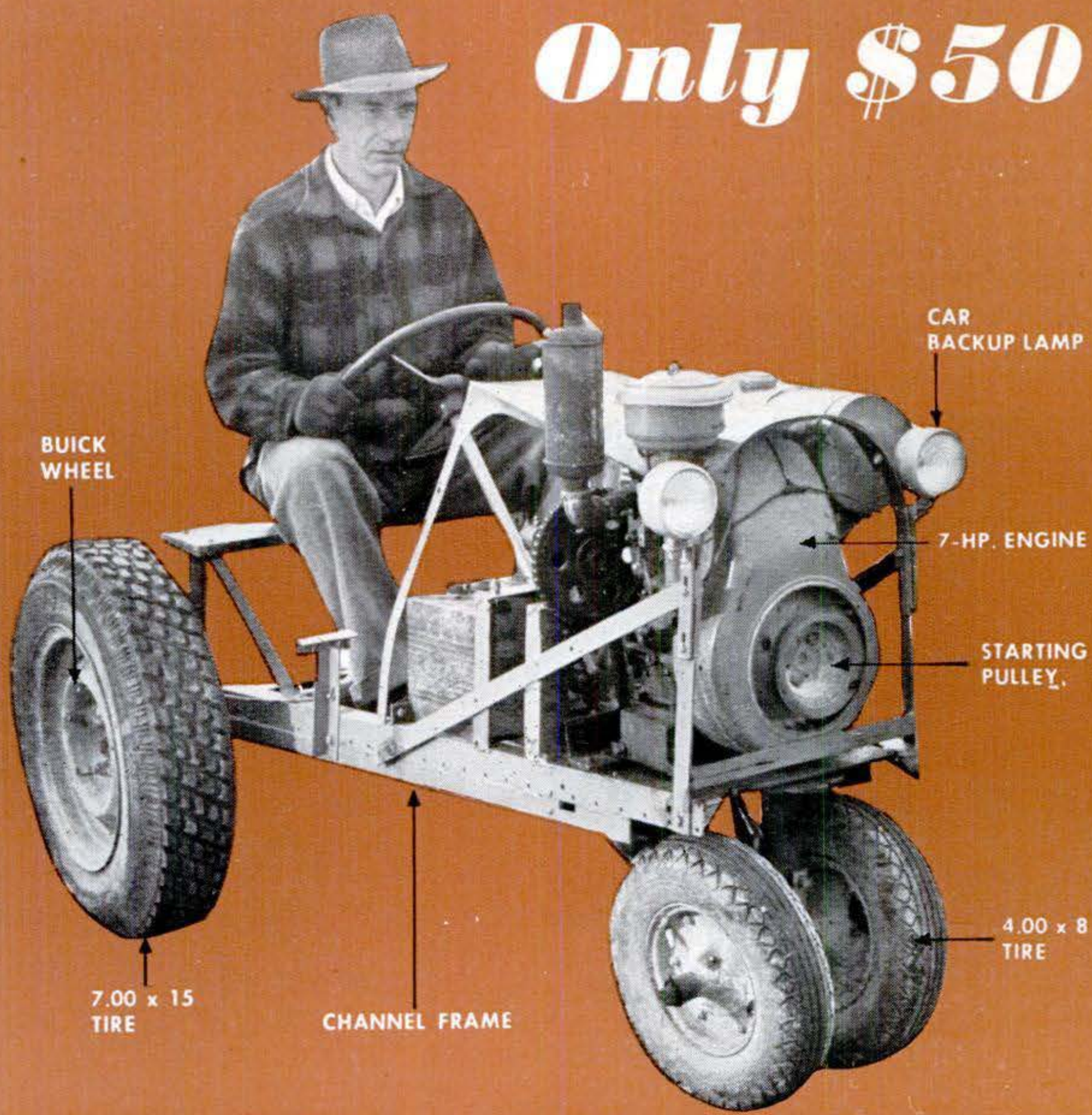
This Tractor Cost Only $50



A powerful midget, it shows what you can do with junk-yard bargains, a hacksaw, and a welding outfit.

PS photos by W. W. Morris

SOON after Paul E. Matous completed his $50 tractor, a friend's automobile got stuck in the mud.

"As a gag, he yelled to me to come and pull him out," says Matous, a building contractor at Orangeburg, N. Y. "He thought I couldn't possibly move the car."

Matous was doubtful too. After all, a tractor with a 7-hp. engine is no road-building giant. Another car already had failed to budge the stuck car, even with the ➡

It weighs 450 lbs. One man can easily tip it over. But don't let that fool you about its stability. The builder reports it never "rears up."

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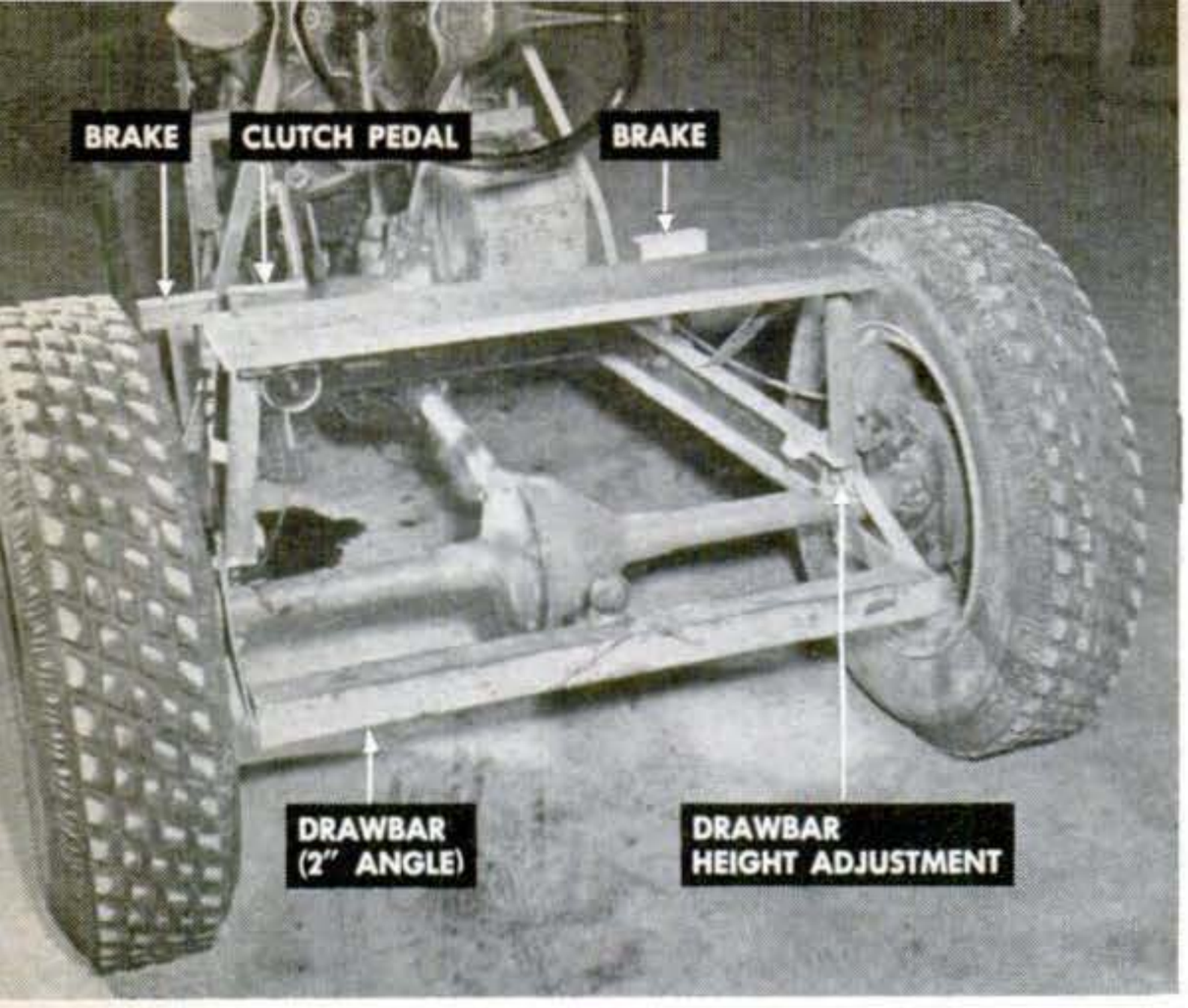
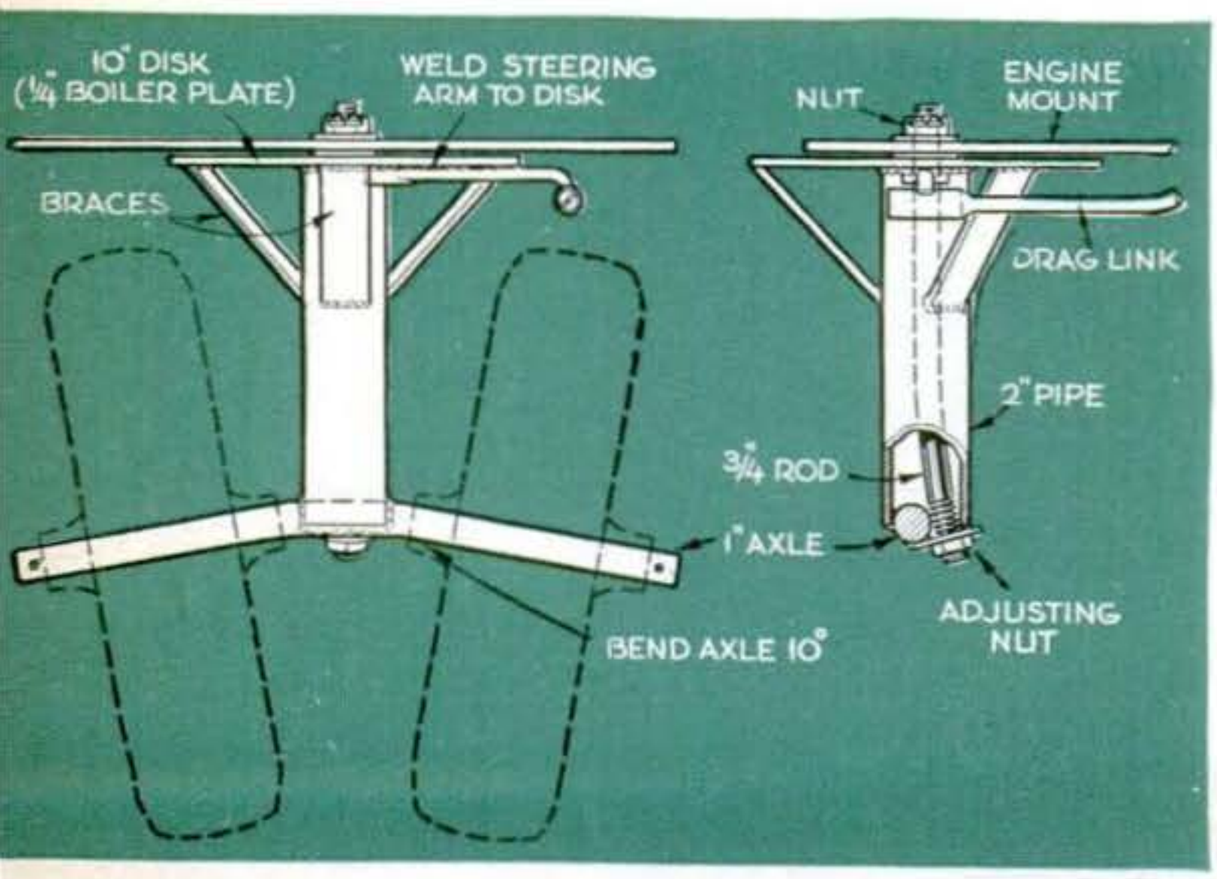


Individual brakes make short turns possible. Axle is hooked in notched frame, but U bolts, as in drawing at bottom of page, would be better.



Front-wheel assembly pivots on a boiler-plate "fifth wheel." A ¾" rod through the 2" pipe ties assembly to boiler-plate engine mount.

help of a couple of well-muscled pushers. As Matous hooked on, the pushers winked at each other. But the little tractor buckled down and dragged the car free.

Matous then turned to the others. "You guys certainly can push," he grinned.

"Push!" one of them said. "We weren't pushing! We were *riding!*"

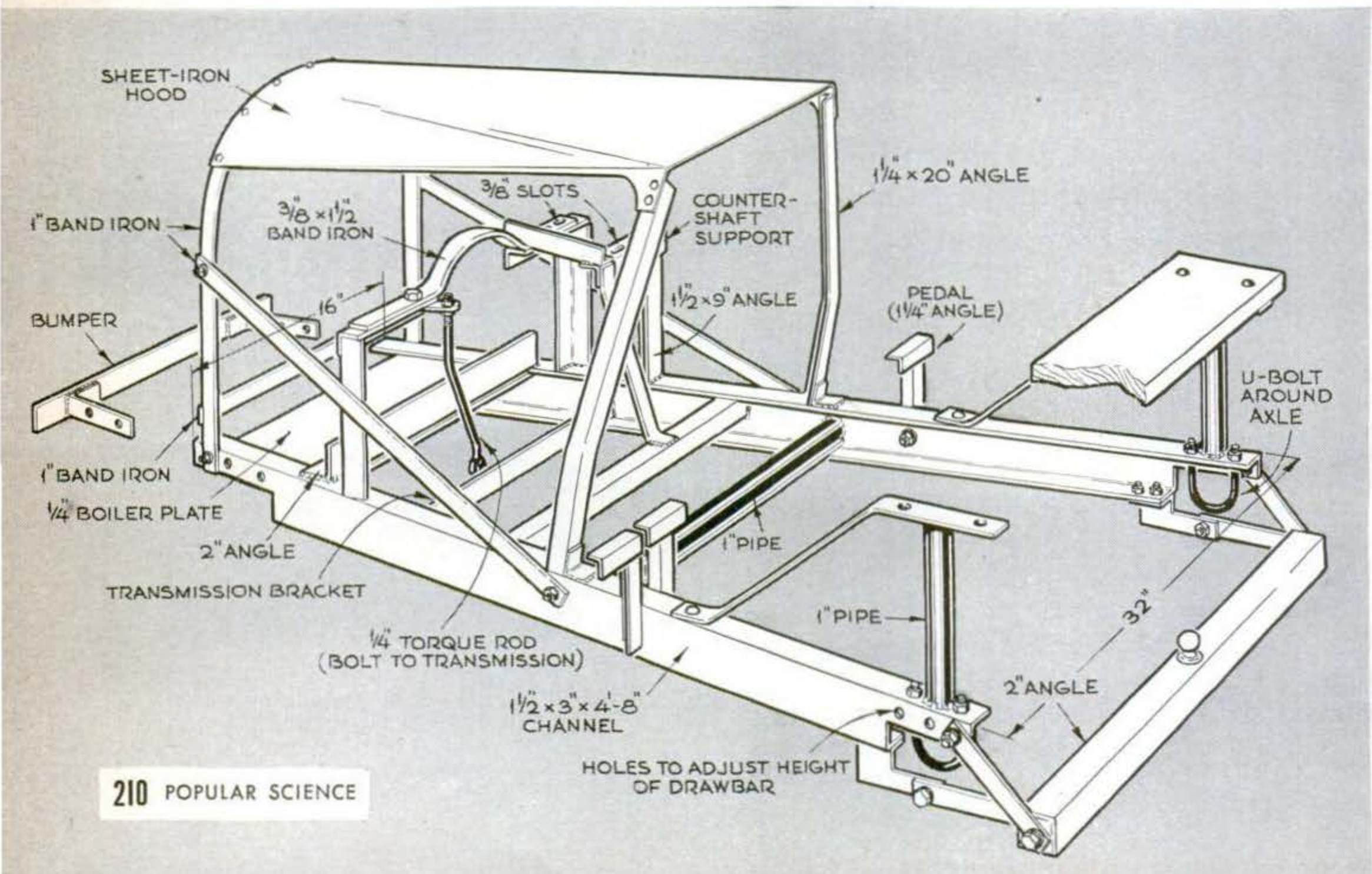
Matous is a shrewd bargainer, as well as a good craftsman. Otherwise, he couldn't have kept the cost of his doodlebug so low. He paid only $35 for a surplus engine—a single-cylinder, air-cooled, four-cycle Briggs & Stratton. A Ford transmission, Ford steering gear, pre-war Austin rear end, and other parts came from a junk yard.

In assembling these, Matous worked mostly with a hacksaw and welding outfit. No machining was required.

The Matous tractor doesn't compare in looks with some of the commercial jobs, but its builder offers to bet it will easily outperform at least two famous makes. On that score, Matous argues with some authority. His main job several years ago consisted of repairing agricultural tractors.

Matous is proud of the tractor's stability. By experimenting, he produced a nice balance between traction and power. For easy maneuvering, the wheelbase was kept short. But so far Matous has not found a situation that will cause the front wheels to leave the ground.

Good weight distribution explains this. The engine rests as far forward on the frame



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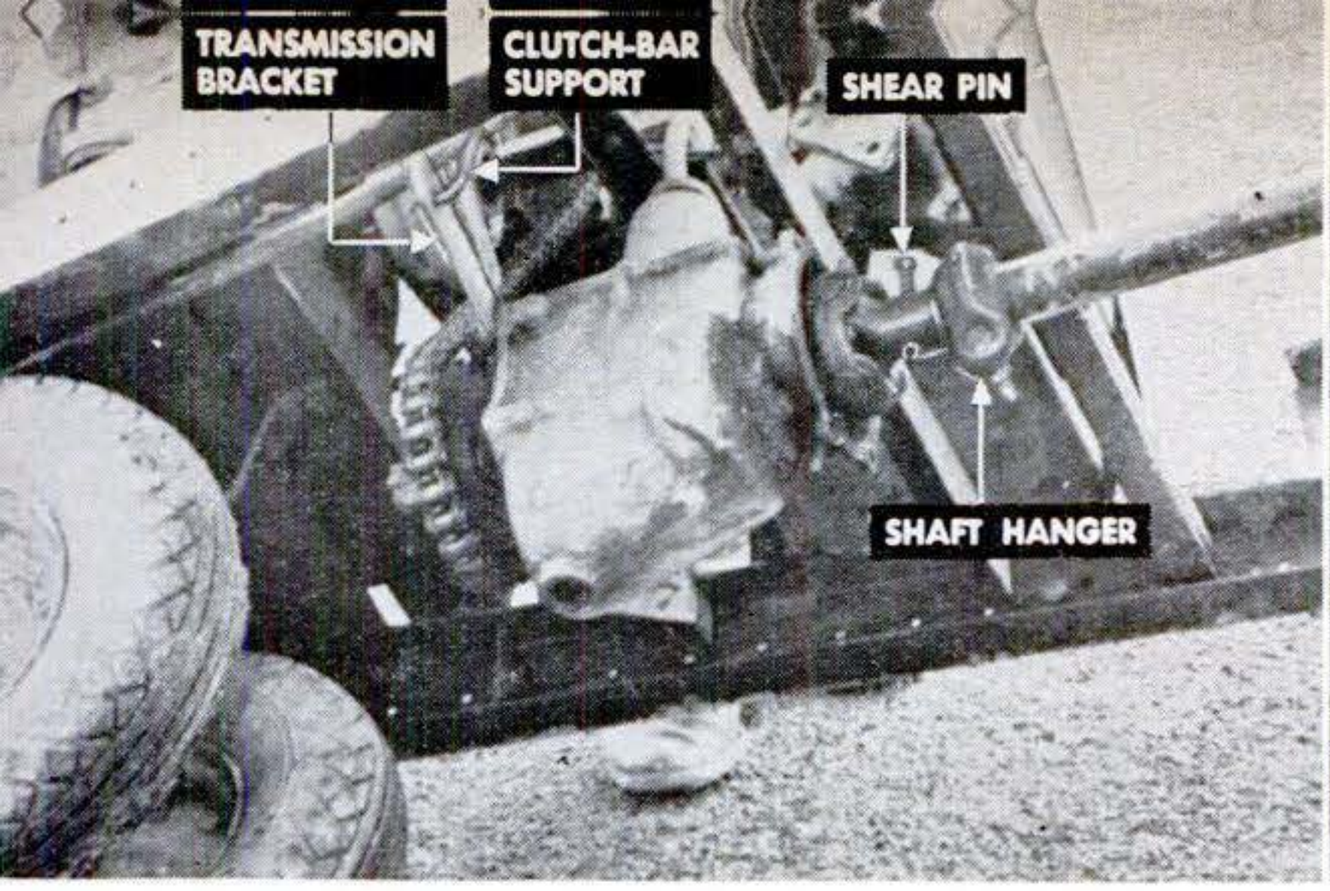
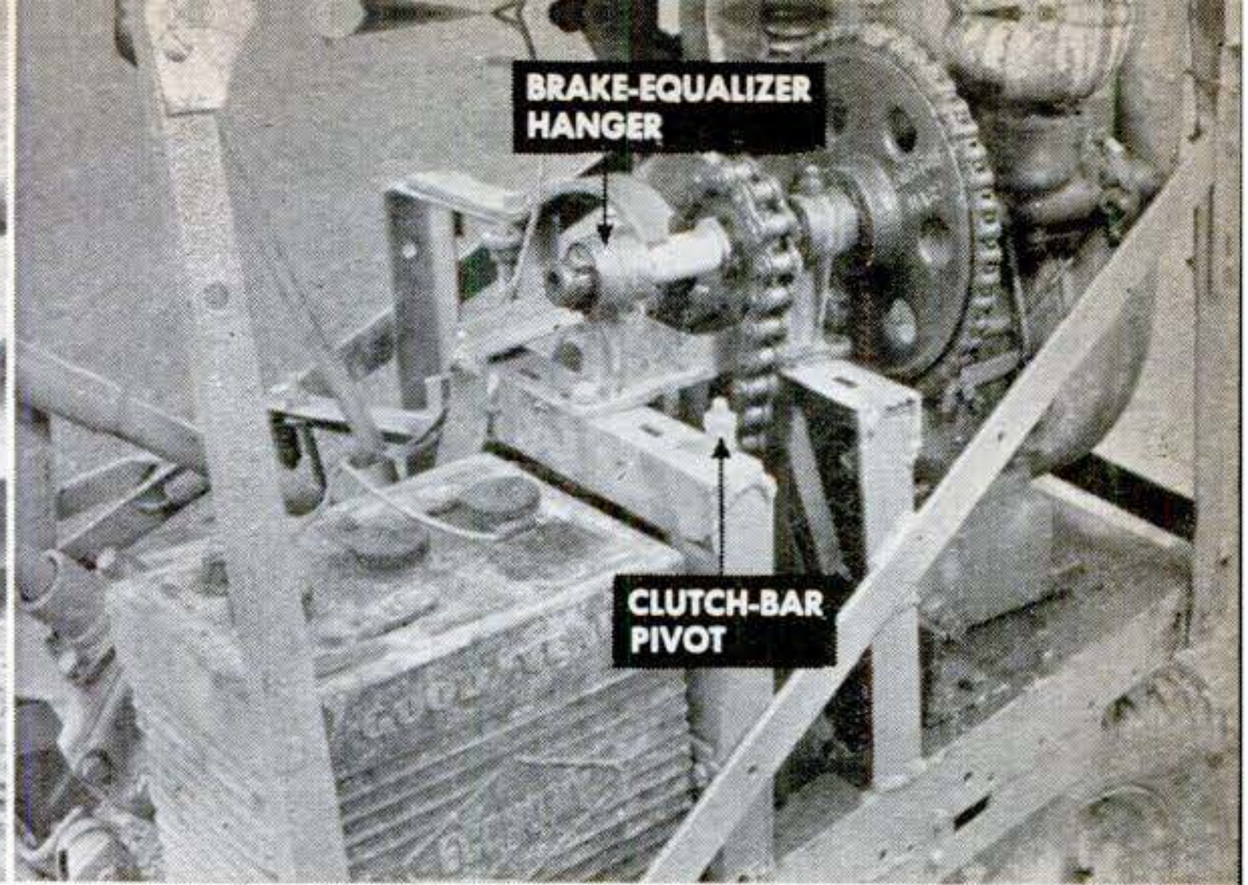
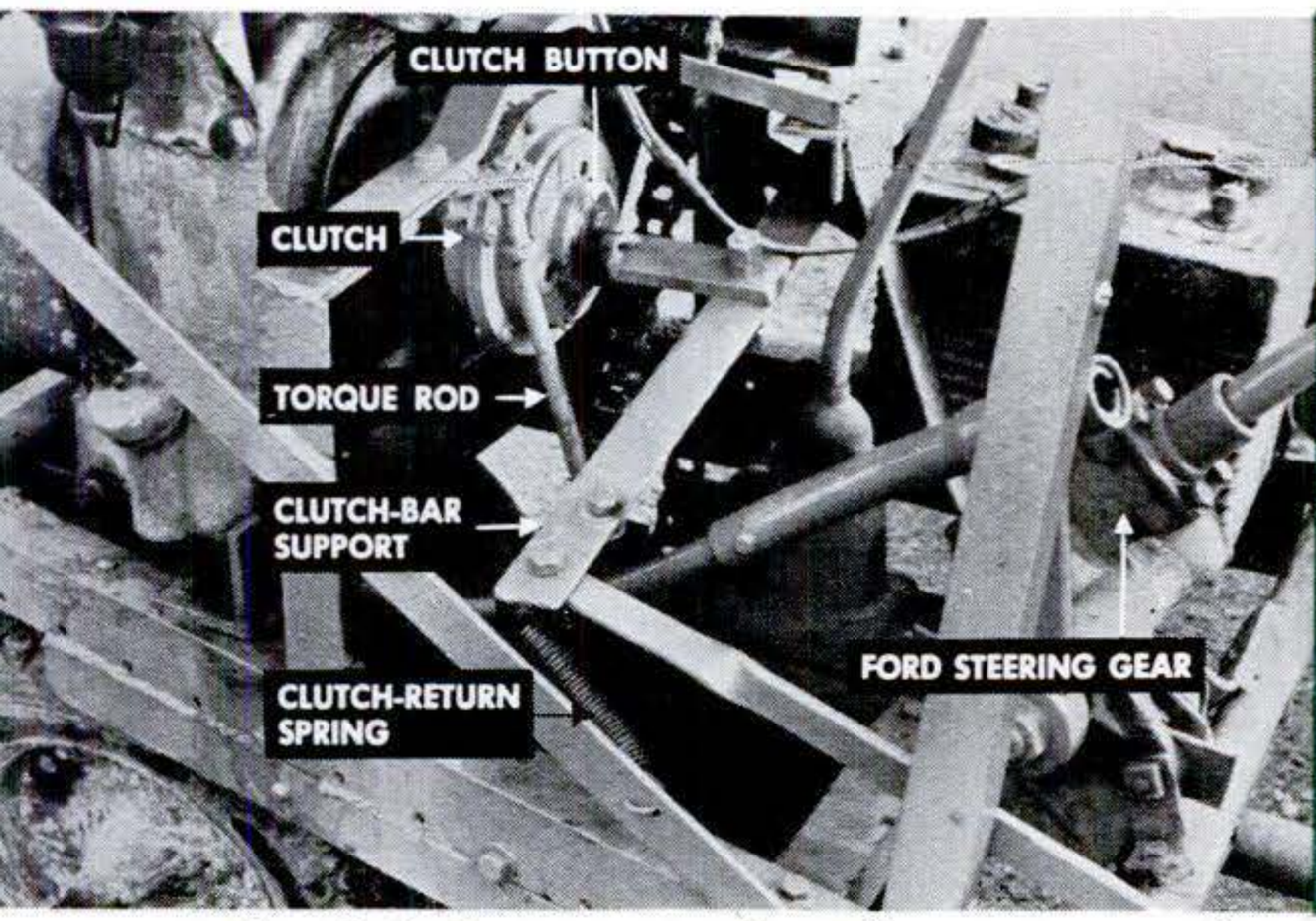


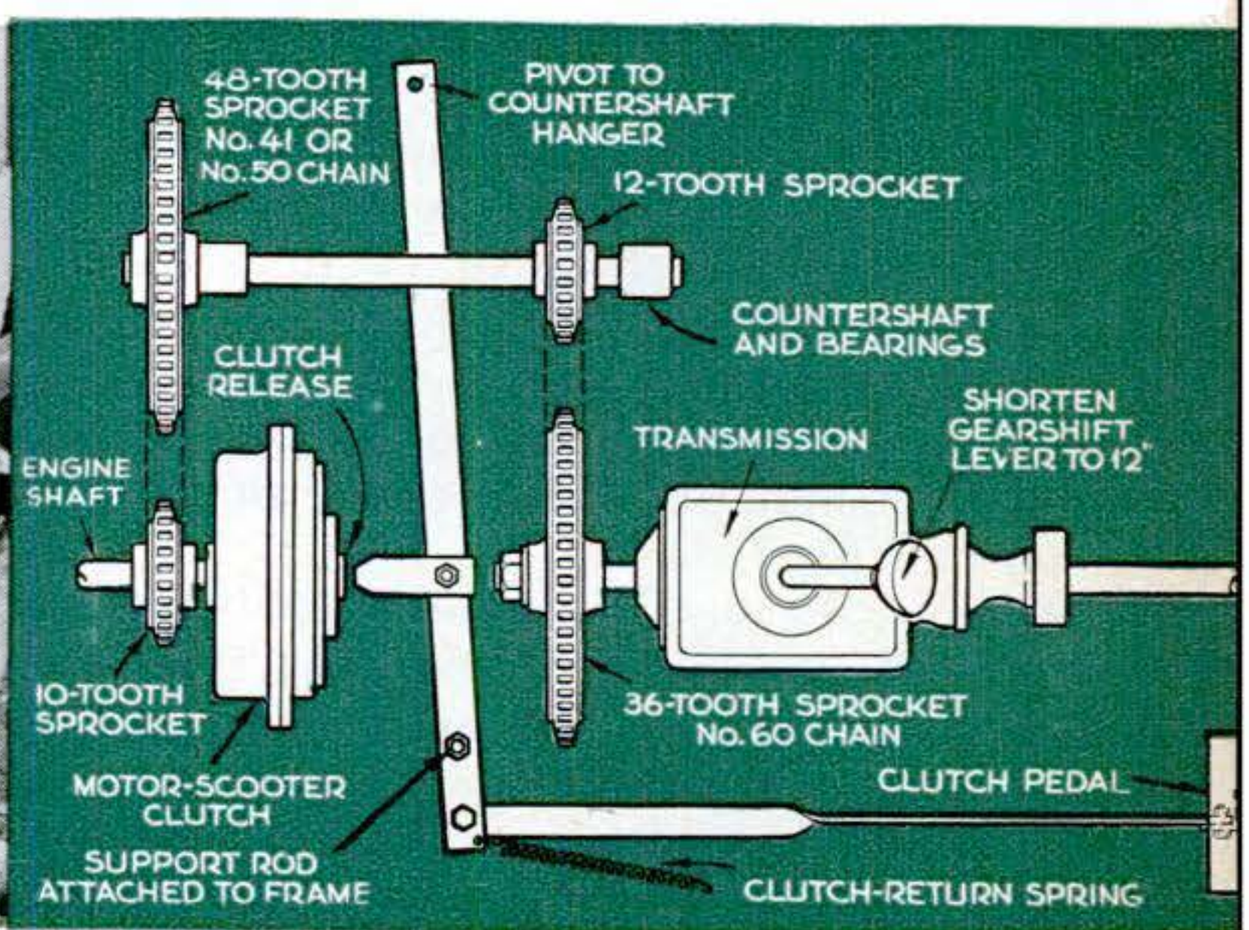
A shear pin protects power train. Universal joint was kept only to make assembly easier. Since rear is unsprung, it could be omitted.



A brake-equalizer hanger from a Ford V-8 supports the countershaft. Drive-chain tension is adjusted by moving the hanger in and out.



Clutch linkage is simple. When you press the pedal, a transverse bar pivots forward. Short arm depresses the button, disengaging clutch.



Sprockets and chains carry drive from engine to transmission. Sketch shows power train and clutch linkage from viewpoint directly above.

as he could get it. This shoves the balance point ahead, but there is no loss of traction. The operator's weight helps here. For some jobs, Matous adds about 100 lb. by filling the rear tires with water.

Sprockets, countershaft, and chains carry the drive to the Model-A transmission. Speeds are about 10 m.p.h. in high, 4 m.p.h. in second, and 1½ m.p.h. in low.

A brake-equalizer hanger from a Ford V-8 provided a readymade countershaft bearing. The shaft itself is a 9″ length of ⅞″ rod, tapped ¼″ deep for setscrews that secure the sprockets. Each of the two bearing points was drilled and tapped for a grease fitting. Bolted through slots to its angle-iron mount, the countershaft hanger can be moved to adjust chain tension.

When Matous set out to build the tractor, he intended to cut down a Ford rear end. But he decided to forego this job on finding that an available Austin unit had the 44″ tread he wanted. He installed this with considerable misgivings. But despite its lightness it has stood up well.

Buick wheels at the rear take 7.00 by 15 mud-grip tires. Inflated to less than 10 lb., these put a large area of rubber on the ground. For some jobs, Matous puts on tire chains.

The front tires are 4.00 by 8 (the wheelbarrow type), standing 16″ high. These roll on a 1″ axle, bent 10° for the proper camber. Welded to the center of the axle is a length of 2″ pipe, welded and braced at the upper end to a 10″ disk of ¼″ boiler plate. In operation, this disk bears against a sheet of ¼″ boiler plate that ties together the front end of the channel-iron frame. A ¾″ threaded rod, running down through the 2″ pipe, holds the wheel assembly to the frame boiler plate. At the lower end, this rod is

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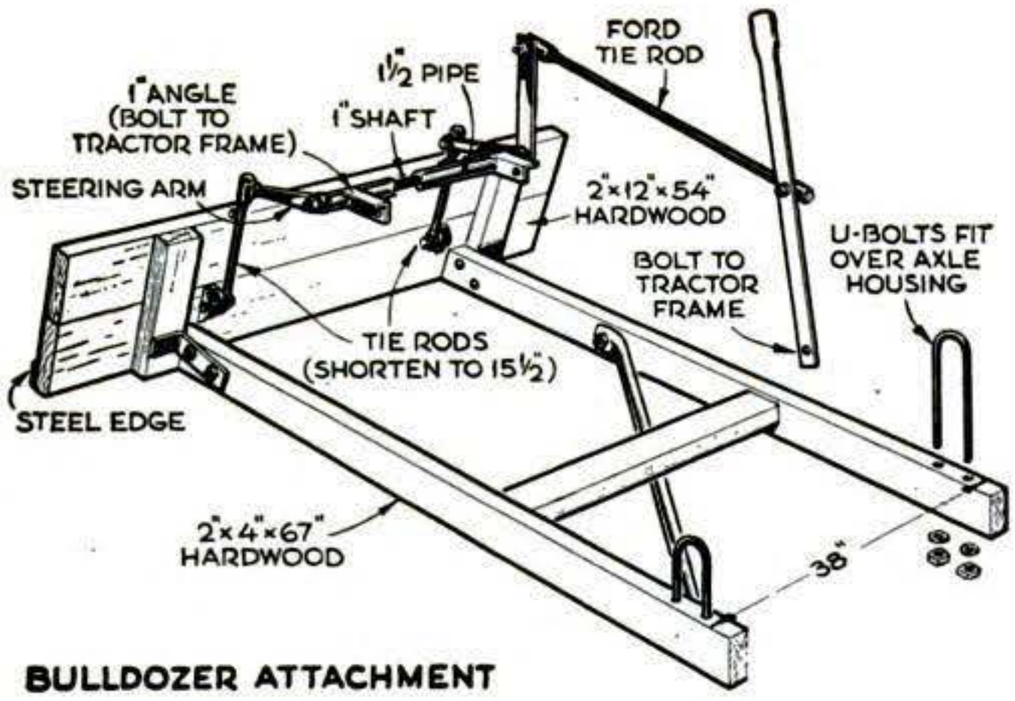

BULLDOZER ATTACHMENT

Homemade bulldozer attachment hangs on rear axle of tractor. As the sketch shows, Matous made generous use of junked auto parts when building bulldozer as well as the tractor itself.

bent toward the rear to clear the axle. A nut on its end provides adjustment.

The steering assembly came from a Ford V-8. After shortening the shaft to 24", Matous reversed and centered the steering arm. Then he attached the drag link to another steering arm welded to the disk.

For the frame, Matous welded together bed-spring angles in channel form. The engine is bolted to the boiler plate that brackets the front end of the frame. For easy starting, the engine is located with the starting pulley overhanging the plate. The tractor has no bumper, but one could easily be added, as suggested in the drawing.

At the present time, the lights draw juice directly from a 6-volt battery. The headlamps are back-up lights fitted with 32-candlepower bulbs. Future plans for the tractor include installation of a generator high up under the rear part of the hood. This part is flat, and for a reason: it makes a convenient spot to lay tools or the gas-can cap.

A remote control for varying the tension of the governor spring from the driver's seat is another proposed improvement. A third is a conveniently located toggle switch to stop the engine by shorting out the magneto.

About the time Matous built the tractor he also bought a tract of rolling woodland. On this tract, which he refers to as his private Aberdeen proving ground, Matous has made the tractor a real workhorse. Among other jobs, he has used it to snake heavy logs, drag a heavily loaded trailer, and level off the ground with a homemade bulldozer blade.

He hasn't yet gotten around to setting it to the routine small-farm and garden chores —plowing, cultivating, mowing, and the like—but he feels confident the machine will take all these jobs in good stride. END

PIPE DIMENSIONS

Nominal Inside Dia.	Actual Outside Dia.	Actual Inside Dia.	Nominal Inside Dia.	Actual Outside Dia.	Actual Inside Dia.
⅛	0.405	0.270	3	3.5	3.067
¼	0.540	0.364	3½	4	3.548
⅜	0.675	0.494	4	4.5	4.026
½	0.840	0.623	4½	5	4.508
¾	1.05	0.824	5	5.563	5.045
1	1.315	1.048	6	6.625	6.065
1¼	1.66	1.38	7	7.625	7.023
1½	1.9	1.61	8	8.625	7.982
2	2.375	2.067	9	9.625	8.937
2½	2.875	2.468	10	10.75	10.019

Note: Dimensions above are in inches, and are for standard steel and wrought-iron pipe.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

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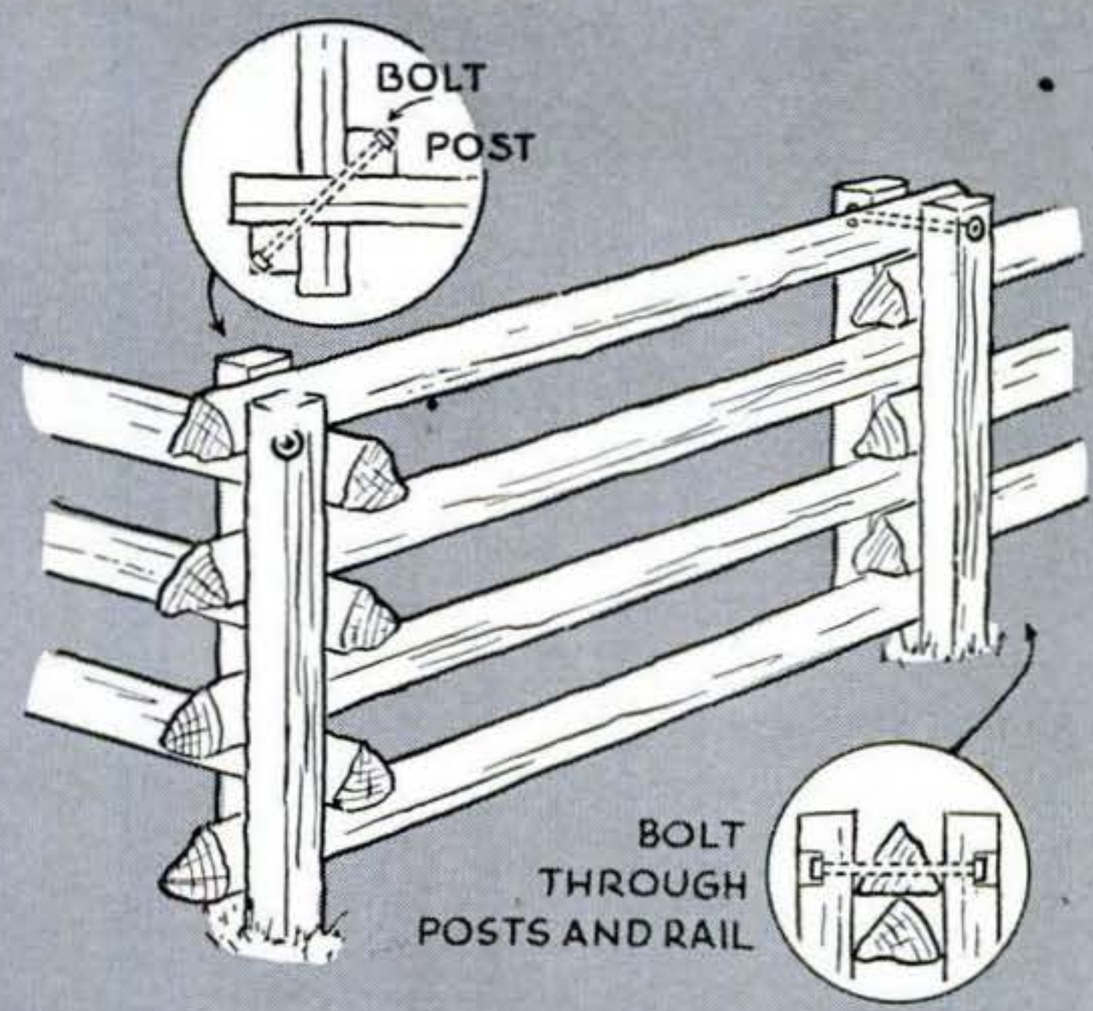
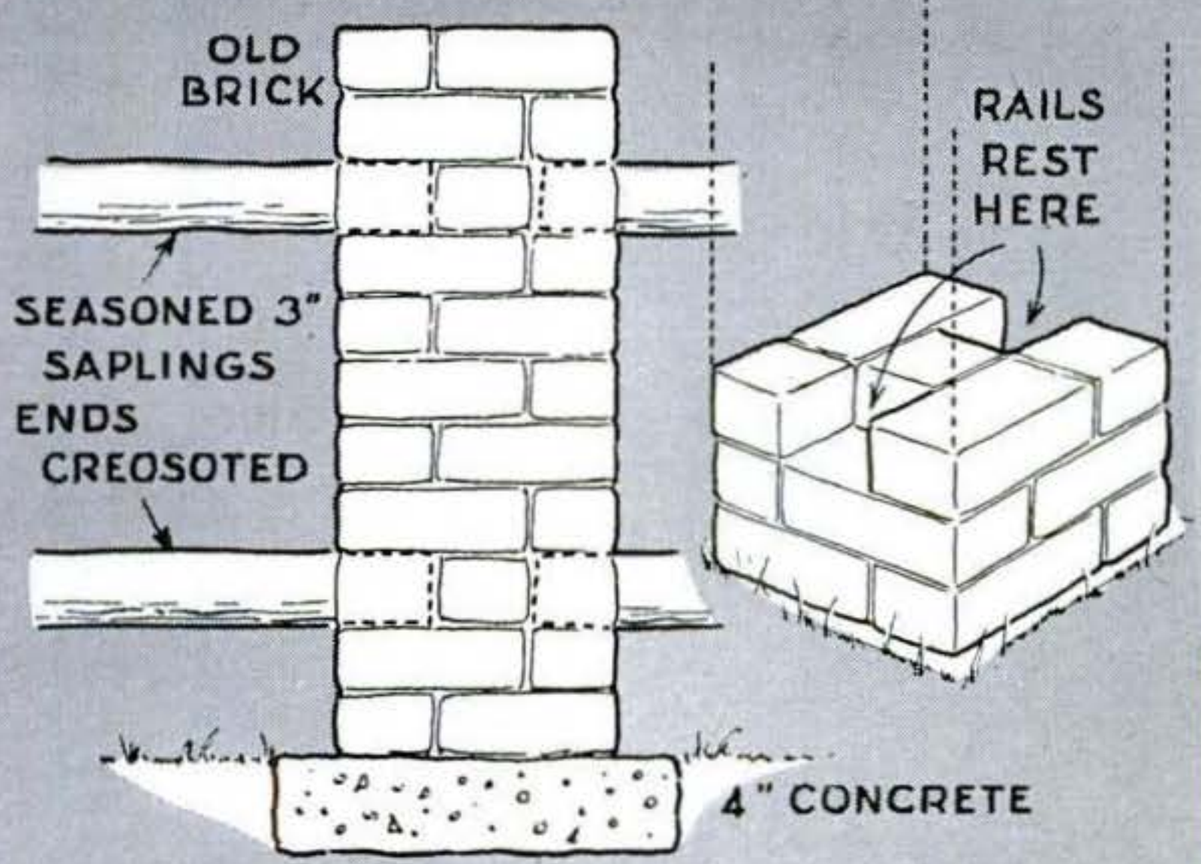
8 of the Many Ways To Build a Fence

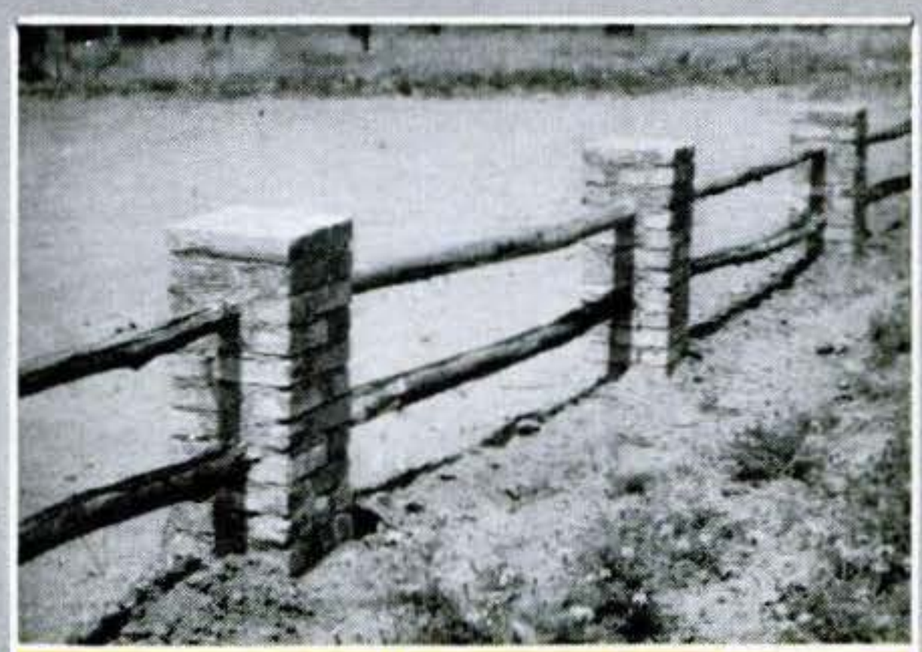
A GOOD-LOOKING fence helps make a house a home. But the fence must suit the house. Look these over—and those on the next two pages—before you roll up your sleeves.

To forestall rotting, always creosote the bottom of fence posts, whether they are set in soil or masonry. If the fence is painted, white is the accepted color for it stands out best against the landscape.



Split rails suit ranch home. These were split from old telephone poles. Bolts hold the top and bottom rails.





Seasoned saplings set in brick piers are an effective combination. Used bricks give a weatherbeaten look.

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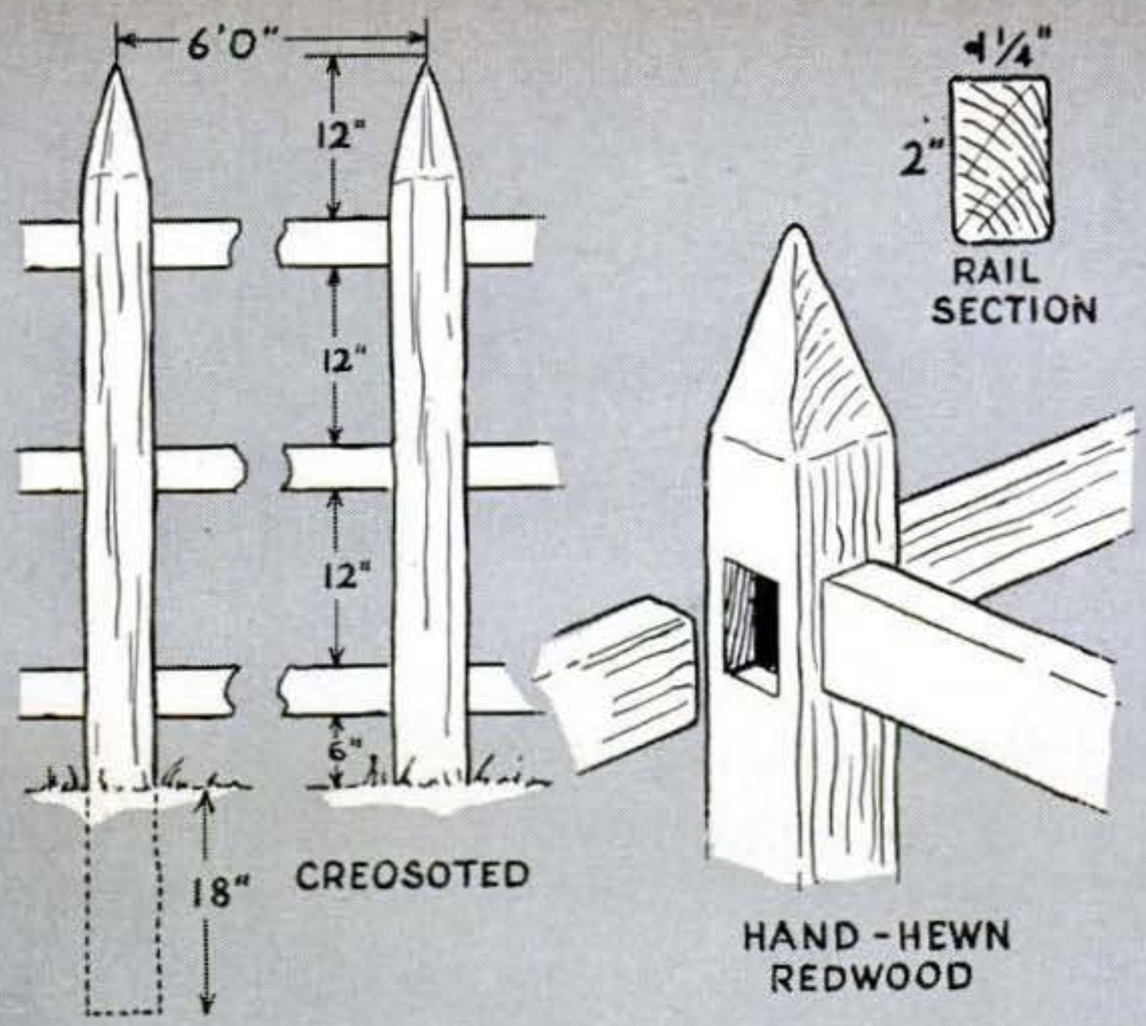
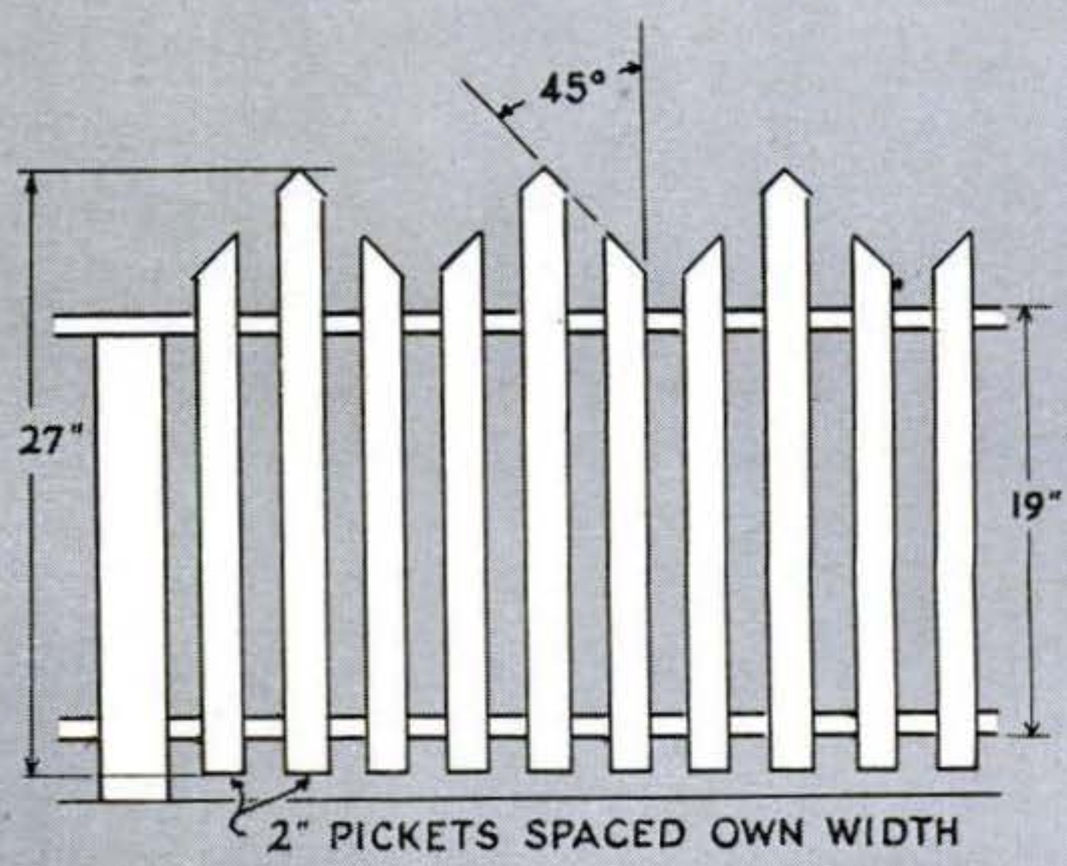
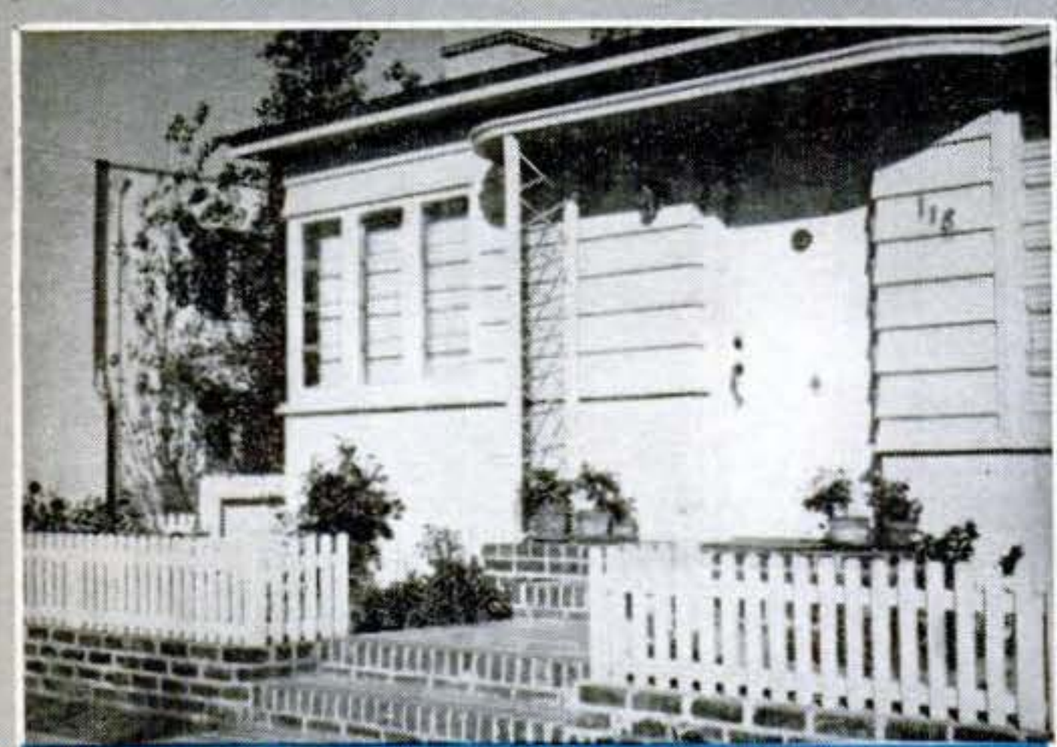
Rot-resistant redwood is favored for unpainted fences. This hand-hewn example is picturesque and easily made.

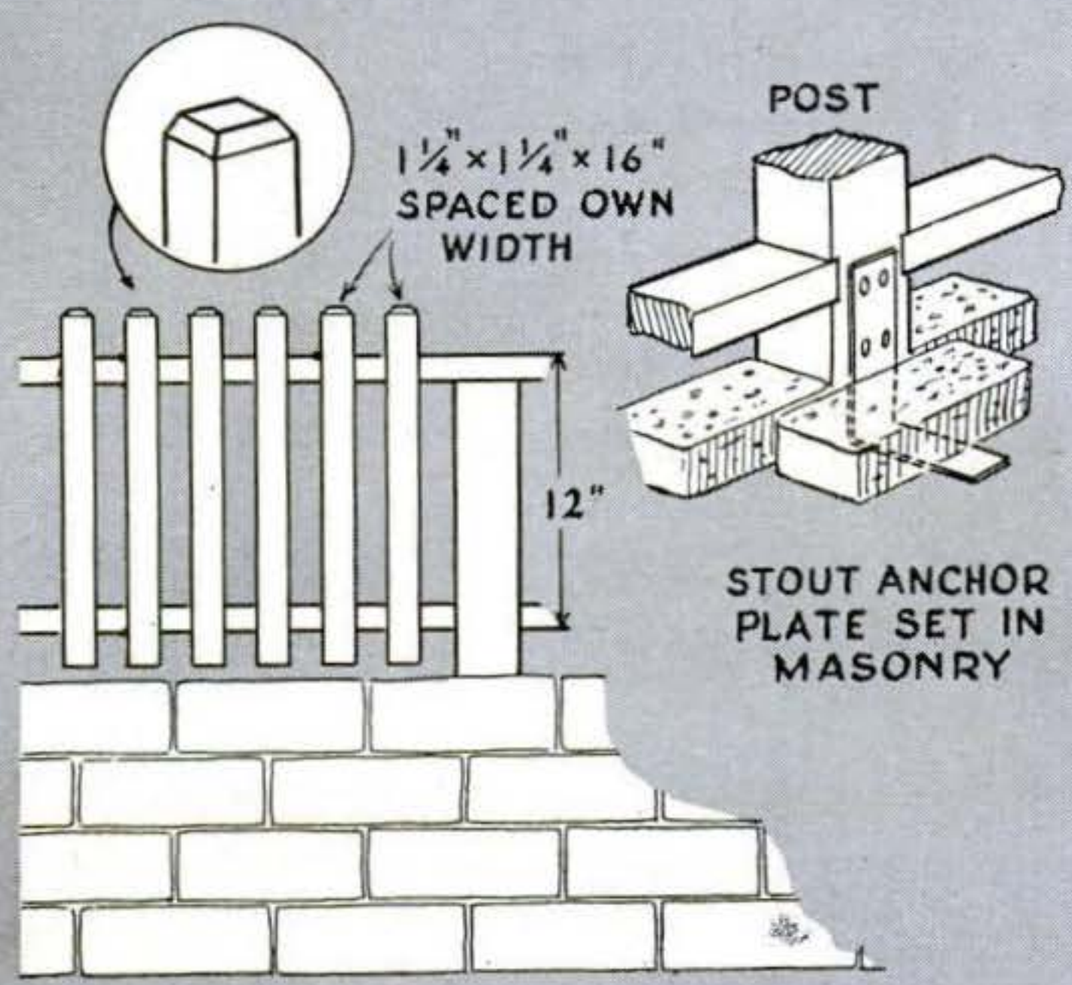


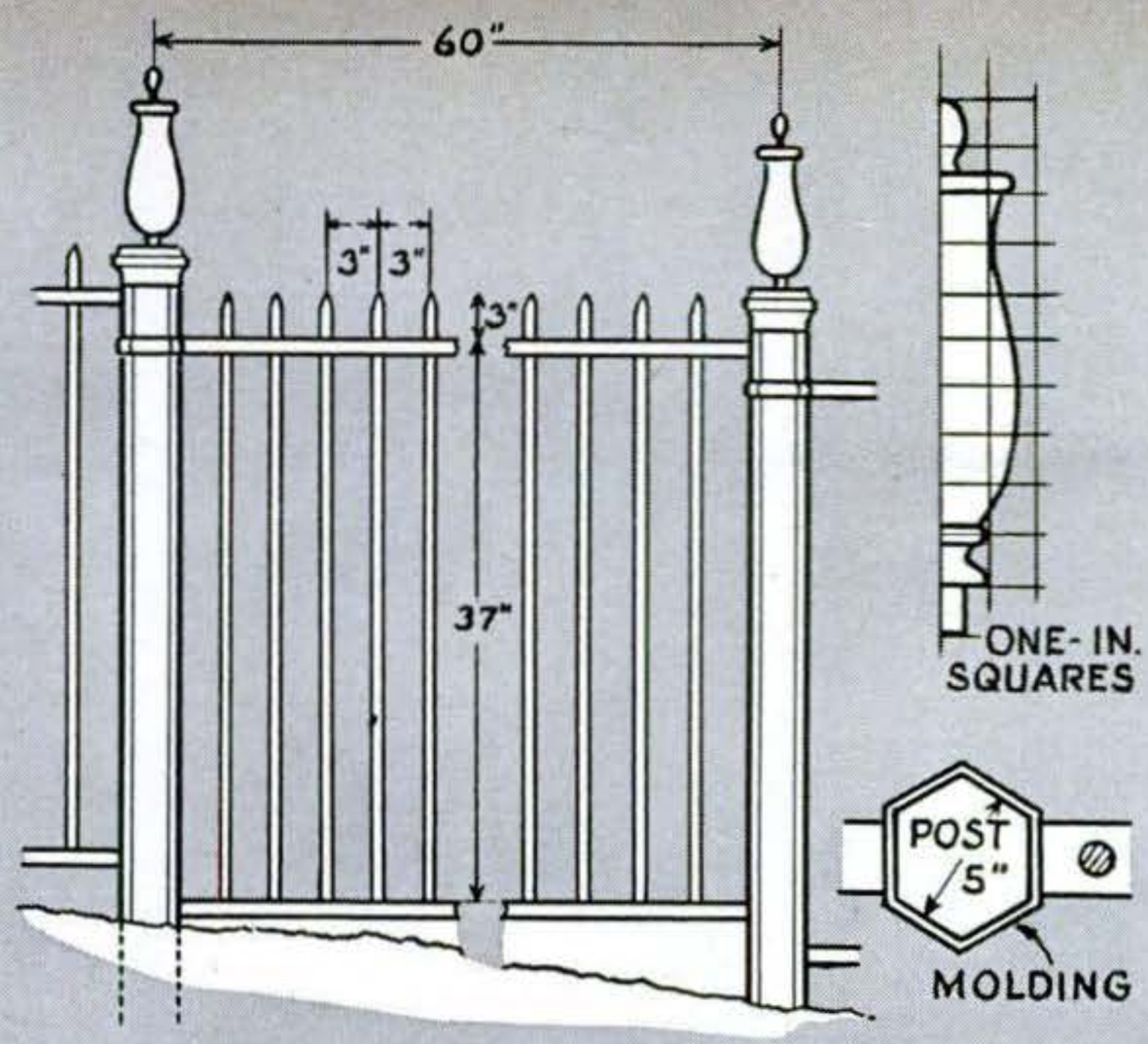
Slope-top pickets are an old favorite. Set the upper rails on square-topped posts. The lower ones can rest on cleats.



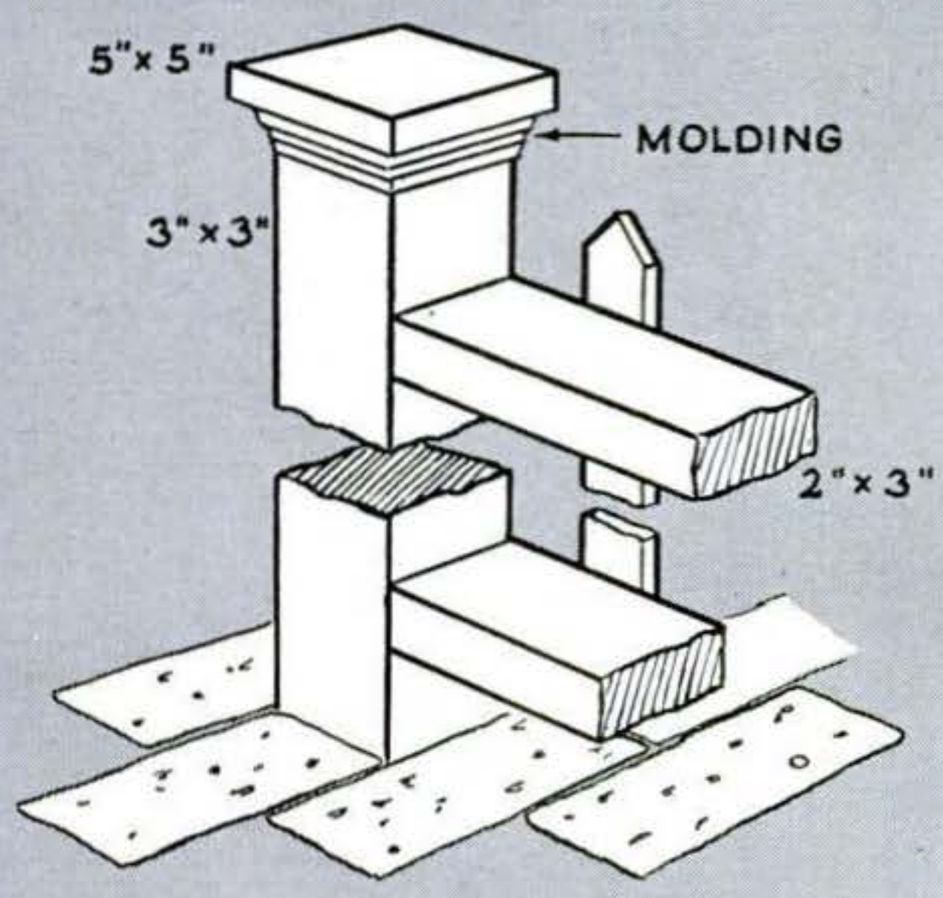


Low pickets atop a brick wall make an effective fence on a slope. Support the posts with metal angles set in masonry.

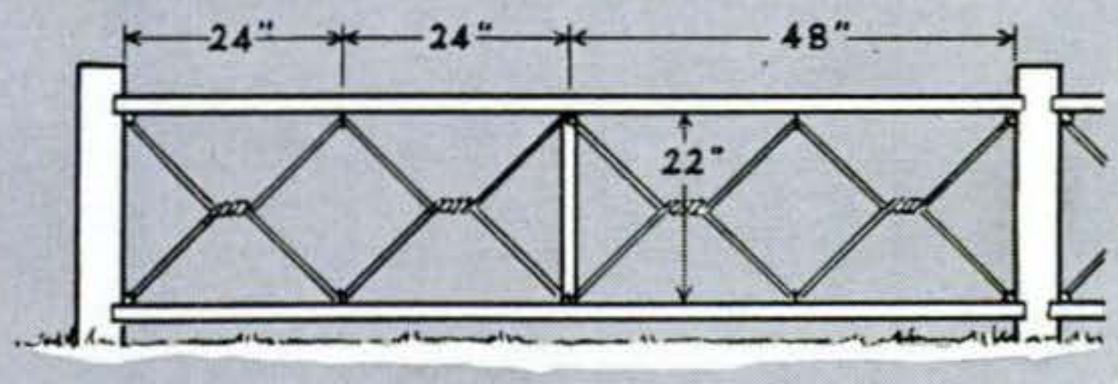


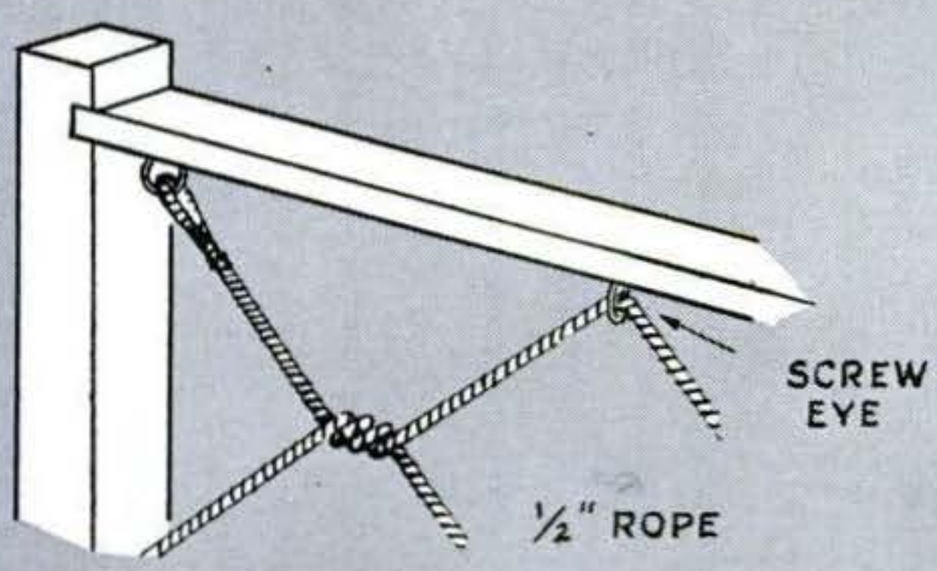


Turned finials and molding ornament the hexagonal posts here. Fence is stepped on a sloping lawn. The spindles are round.



Square-topped posts at corners and gate improve the looks of conventional picket fence. Rails can be mortised in posts.



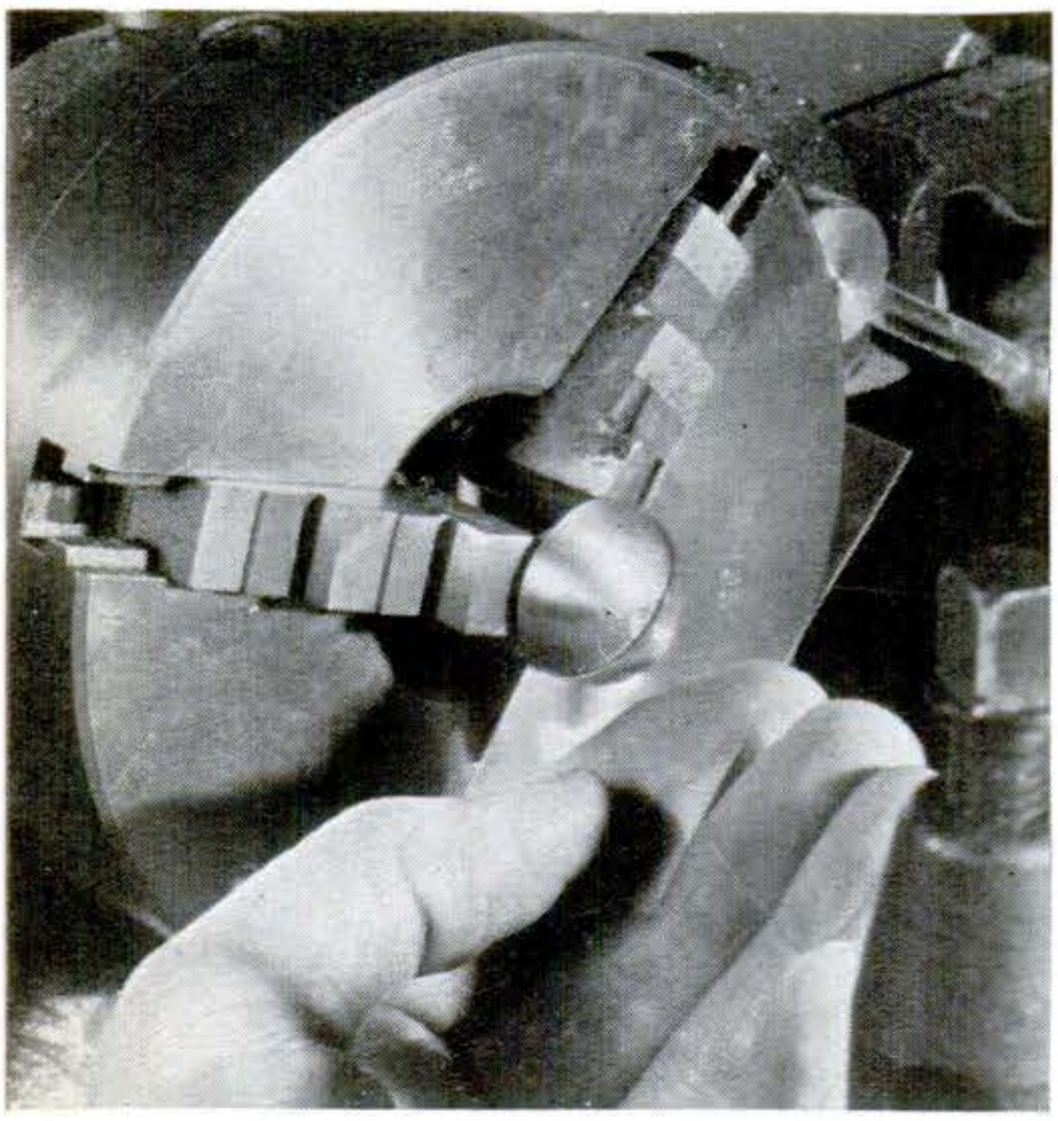


Rope strung diagonally makes an appropriate fence for a beach home. Use ½" hemp and run it through big screw-eyes.

Centering Odd-Shaped Work. Put together in a few minutes, this wiggler indicator does a good job of centering punch marks on work in the four-jaw or on a faceplate. The needle is ⅛″ drill rod, ground to a 60° point at one end and a long taper at the other. A collar with a convex face is driven on, this face away from the point.

For the shank, cut a piece of bar stock to fit the tool post. Attach to it with rivets or small bolts a fragment of hacksaw blade shaped as shown. Grind off the teeth, and anneal the ends to drill the holes, leaving the center part hard. Ream the ⅛″ hole a close fit for the needle.

In use, the blade should hold the point in the punch mark on the work under slight tension. It helps to see any wobble if you run the tailstock center up to the other end. —*Robert W. Mapes, Binghamton, N.Y.*



Template Shows Turned Shape. Turning templates cut from acetate film have two advantages. The contour is easily cut by scribing it on the material and carefully breaking the inside waste away. Semicircular templates are formed by swinging dividers to the required radius. Furthermore, the transparency of the template lets you see where it doesn't fit, and what parts of the contour must be turned down most.

Don't Drop Lathe Chucks. Nobody wants to, but that last bit of thread sometimes lets go when you least expect it. A good safety habit is to screw a heavy chuck back on just a part of a turn each time you let go to take a new grip.

Screwdriver from Old Valve. The high quality of the steel in auto valves makes this a fine shop tool. Three ⅛″ holes are drilled 120° apart through the head, from the underside. Countersink for flathead wood screws and attach a hardwood block. Then chuck the stem in a lathe or drill press and turn the handle to shape. Grind the tip slowly to preserve the temper. Polish on a wire wheel or with emery cloth.—*A. Wayne Argabrite, Denver, Colo.*

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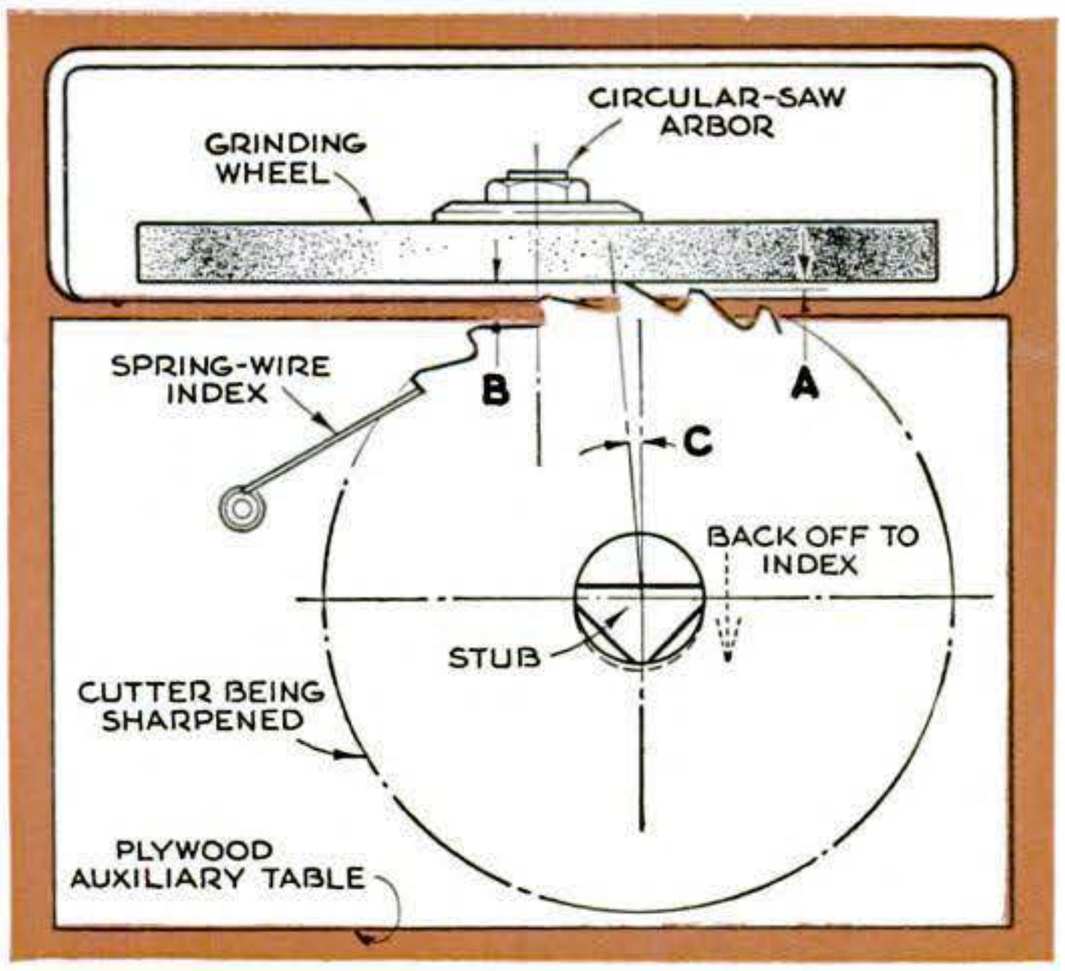
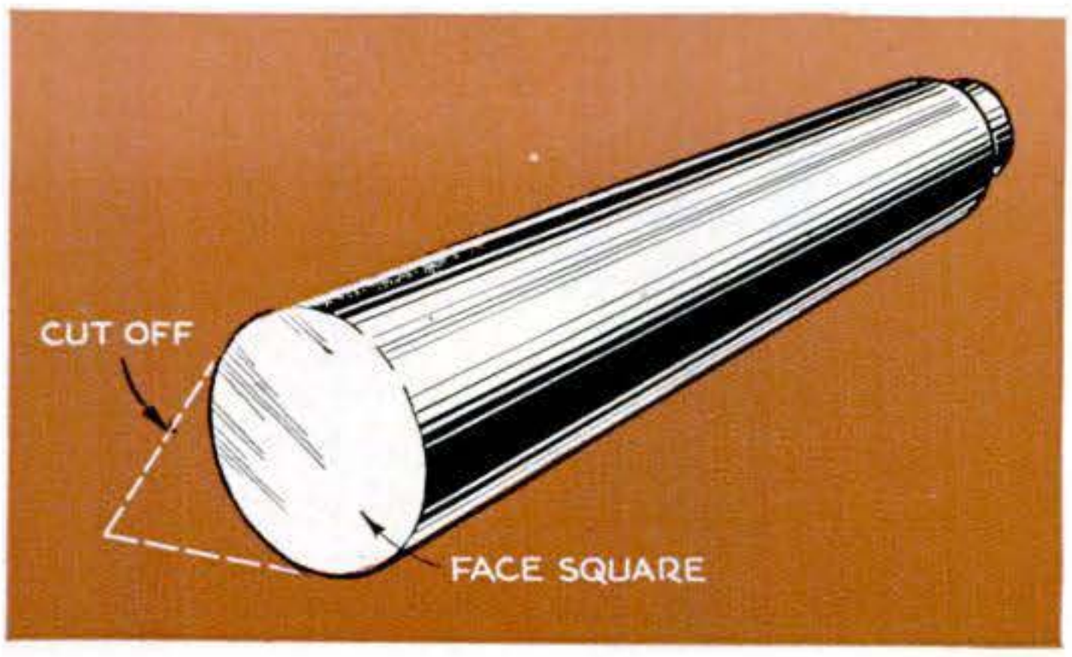


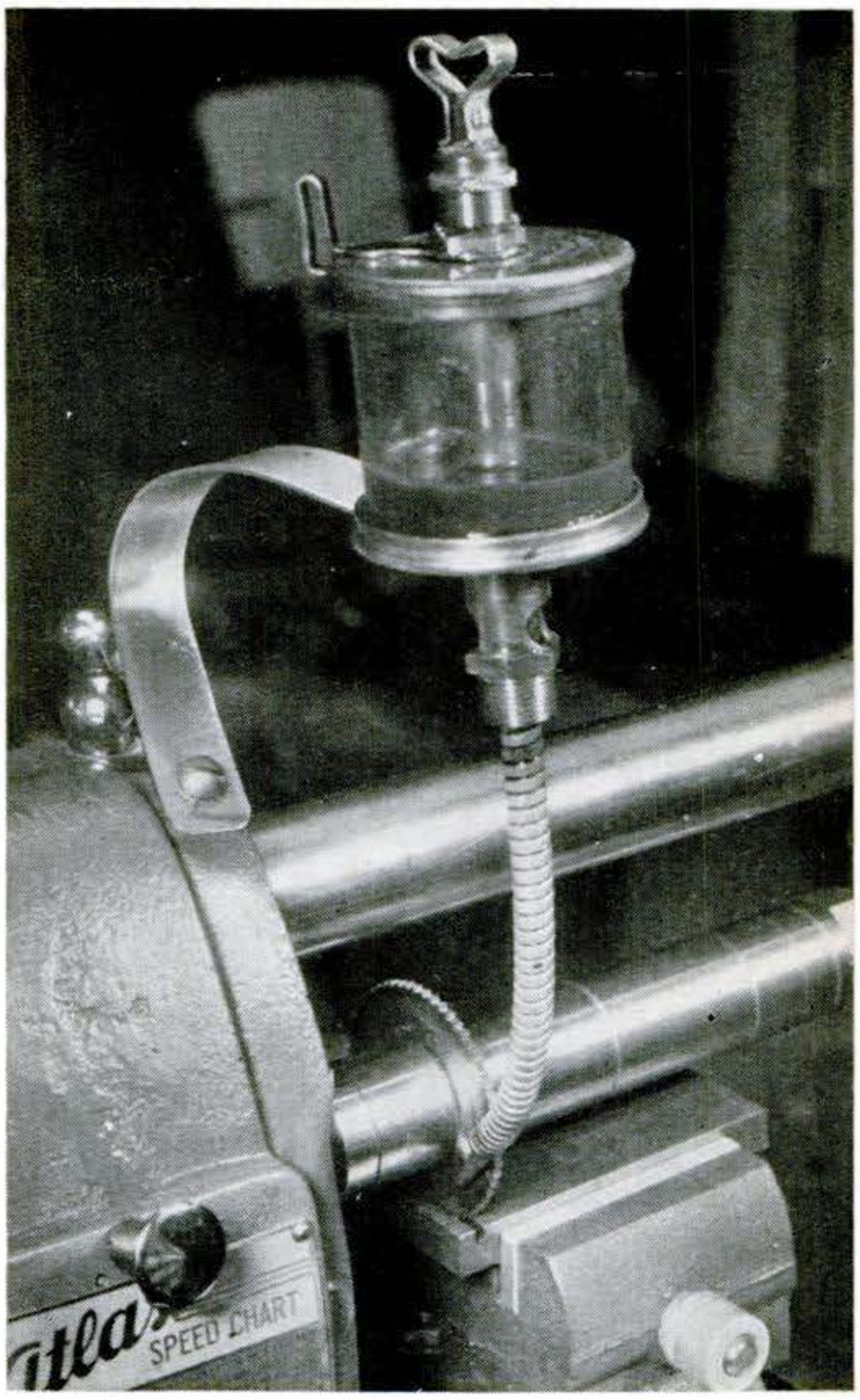
Cutters Ground on Saw. Milling cutters can be ground on a circular saw with this setup. Remove the table insert and mount a suitable grinding wheel. Then clamp on a plywood auxiliary table beside the wheel. In a hole in this table insert a triangular stub, shaped from maple dowel, that's slightly smaller than the cutter hole. With a wood screw, attach a piece of spring wire or clock spring as an index.

With the wheel stationary, set up the work so that the distance from the cutting edge to the wheel at B is greater than at A, giving the clearance angle C. Set the index against a tooth. By moving the cutter against the wheel until stopped by the apex of the stub, you can grind all the teeth to equal length.—*A. R. Christensen, Lockport, N.Y.*



Center Forms Drill Pad. A small drill pad, quickly made from an old live center, affords a square support for dies or for work to be drilled in the lathe. It's also useful as a stop in cutting off duplicate pieces, and for holding work in the four-jaw chuck or faceplate while centering it.

Tap the center into the headstock spindle, cut off at the greatest diameter, and face square.—*Joseph Tracy, Long Island City, N.Y.*



Cup Feeds Cutting Oil. A flexible oilcan spout and a strip of brass transform an oil cup into a good lubricant feeder for the lathe, drill press, or milling machine. The cup has a valve that can be regulated to meter the flow, and the spout is adjustable to put the fluid where it's most needed.

Cut the threaded cap off the spout and solder the latter into the bottom fitting of the oil cup. Tap a couple of holes for screws to hold the brass strip, or simply solder it to the bottom of the cup. Tap a hole on the machine to mount the strip, if one isn't there.—*Will Thomas, Kenmore, N.Y.*

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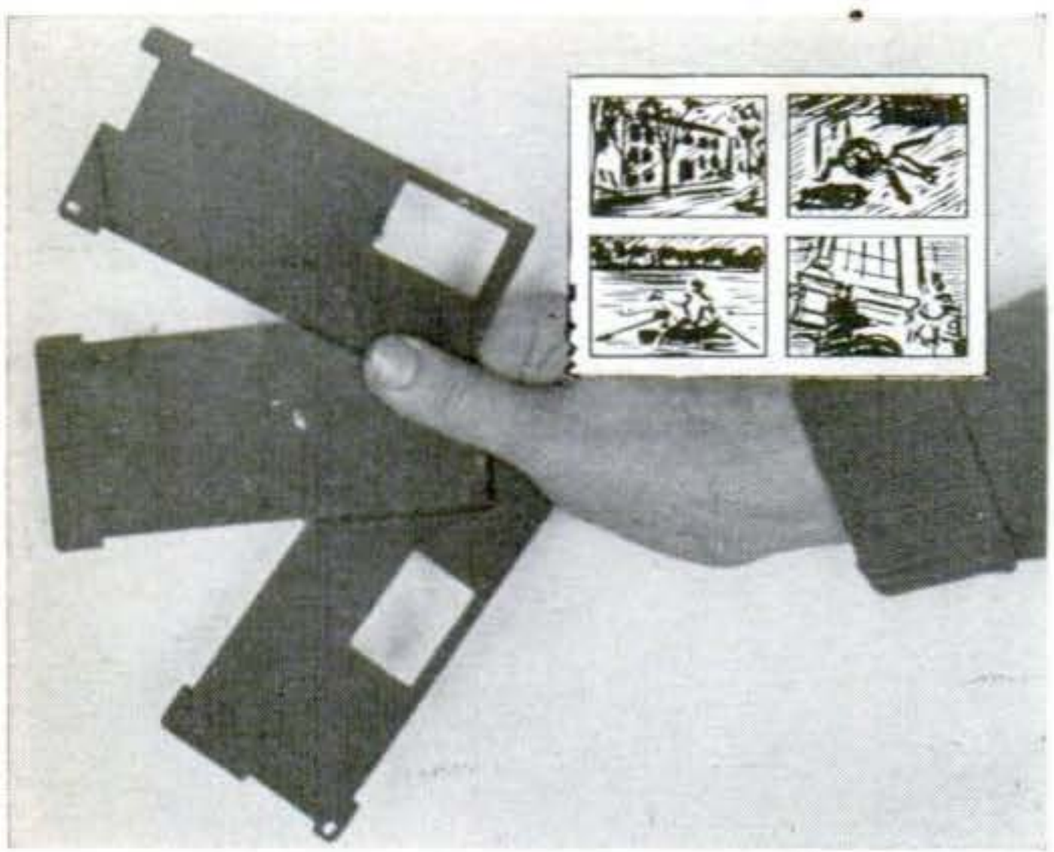


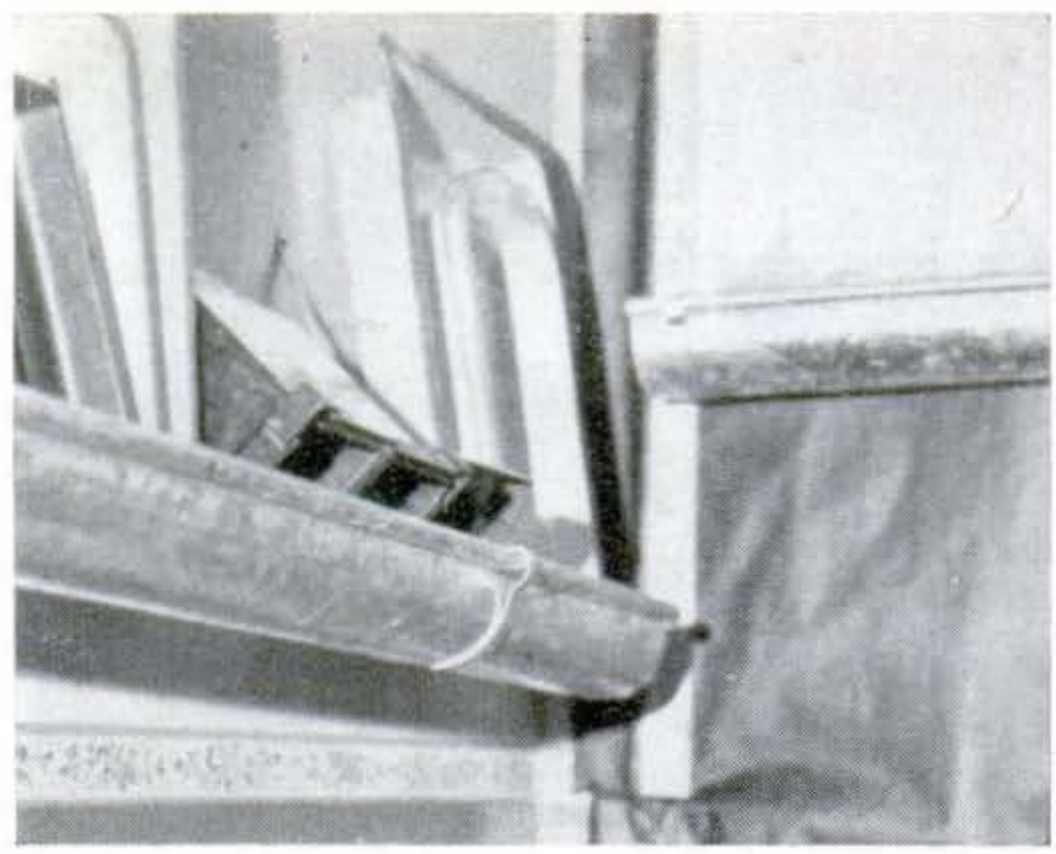
Four Photos on One Film

IF YOUR camera uses 2¼″ by 3¼″ film holders, these masks will give you four 35-mm.-size color shots on each sheet of color film. This will make it possible to produce slides at a cost comparable to those taken with miniature cameras.

R. and M. Products Development Co., of Detroit, Mich., supplies the Colo-Masks® in sets of three—two with openings and one solid. One mask and the solid slide replace the regular film-holder slide. Turning over each mask gives a new photo area on another quarter of the film. The ground glass or viewer must be marked accordingly.

Title Movies on the Spot

WITH the Poc-Ette Movie Titler®, you can work titles or notations into a sequence of scenes while taking them. The accessory has a supplementary lens in a housing that fits over the regular camera lens. Pencil notations are made on a glass that slides into the end of the housing. You photograph this by aiming the titler at a light and running the camera, set at infinity. Zusser Mfg. Co., Chicago, sells the device for $3.



Trays Drain in Roof Gutter

YOU can put a couple of lengths of ordinary roof gutter to good use in a darkroom. Fasten them to the wall at a slight slope, with the lower, open end over the sink. Use the gutters as racks to hold your wet trays and glassware, and they will drain into the sink.—*Robert Chambers, Knightstown, Ind.*

The Height of Ingenuity

There always comes a time when an amateur photographer gets tired of agitating his film tank. I have read of a lot of fancy inventions to do the job automatically—but I don't need any of them. Here's what I do:

After loading the tank, I place it between three stops on a flat board. Under this board are two cleats, so spaced that they are a snug fit between the rungs of my rocking chair. With the board and tank in place on the chair, I just sit down and rock—and enjoy the latest issue of POPULAR SCIENCE. *— Frank Pigford, Jr., Cartersville, Ga.*

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A bit of humor. Here, the boy at left becomes the center of interest. The photo tells a story, but it doesn't especially evoke Mother's Day sentiments. As for composition, the vital points of interest, such as the heads and candy box, are placed near the edges of the picture, leaving a "hole" in the center.

Mother's Day Photo Problem

WHICH of these three pictures is the best photo for Mother's Day?

All three were taken by W. W. Morris, POPULAR SCIENCE chief photographer. One illustrates many of the mistakes amateurs often make. Another focuses the attention in the wrong way for the occasion. But one of them conveys the impression the photographer wanted.

Here's the story—and the photo tells it all. Billy pecks Momma's cheek while Peter watches, and Mamma becomes photographic center of interest—as she should be. Photo was carefully posed, but it gives appearance of a scene that could happen without any planning. Another good point: diagonal lines formed by boys give photo a well-knit composition. Note that plain wall used for background gives no distracting influence.

Cluttered background and stiff poses put this picture close to the bottom of the amateur class. The boys are both mugging the camera, and flowers appear to grow out of the older boy's ear. Mother's thoughts seem to be far away, and the vase detracts from her face.

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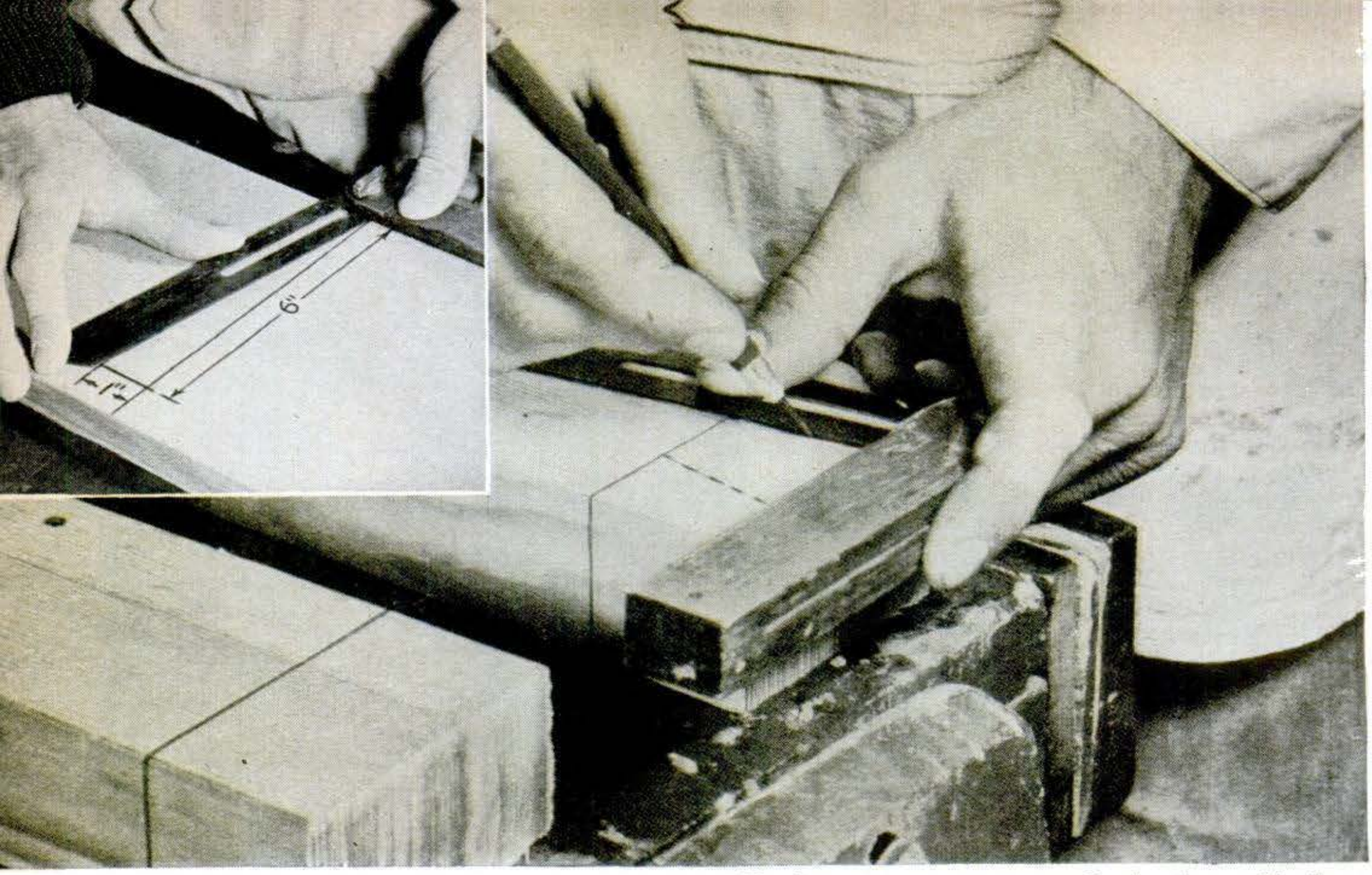

To lay out a common single dovetail, draw lines around each piece the thickness of the mating piece from the end. Divide one line into thirds, set your bevel square as in the small picture, and use it to draw the sides of the pin.

How to Make Dovetail Joints

By Edwin M. Love

NO JOINT surpasses the dovetail in strength and reliability. Named for its resemblance to the spreading tail of a dove, it consists of a wedge-shaped pin locked in a socket. Such a joint has rigid strength independent of the holding power of glue.

Although not often used for such jobs as joining the frame of a fence gate, a common *single dovetail* is tops for such purposes, and a home mechanic who does not have to worry about labor expense can use this superior construction method.

When the wedge does not extend through the mating member, a dovetail is said to be *lapped*. A *half-lap dovetail* is a counterpart of a half-lap joint, with the pin cut in half the thickness of the material and sunk flush in another member set at right angles. This kind of joint is useful in such light construction as joining a drawer runner to the front rail of a cabinet. Teamed up with another dovetail (often of different size), it may lock a side as well as a front rail to the corner or leg of a piece of furniture. And the same joint may be used in heavy timber to assure a solid beam assembly for a garden pergola or the like.

Multiple dovetails are made by ganging single dovetails. The common kind, exposing the ends of the pins, makes an excellent corner for a heavy chest or tool box. And *half-blind multiple dovetails,* in which the pins are cut short enough to be hidden, are found in all fine furniture.

Dovetailed cleats often are put on the ends of drawing boards or breadboards to resist warping while permitting free expansion and contraction of the boards as the humidity varies. And bookcases and similar projects occasionally are assembled with *housed dovetails,* which are dovetail tenons on the shelves locking into fitted dadoes.

Two "secret" dovetails also have been devised to give some of the strength of the conventional joints despite total concealment of the pins. The easier of these to make is the *blind square lapped dovetail,* which resembles a rabbeted joint. The other is the *mitered secret dovetail,* masquerading as a mitered joint. The latter is rarely used, however, because of the labor involved and the impossibility of observing the accuracy of the fit.

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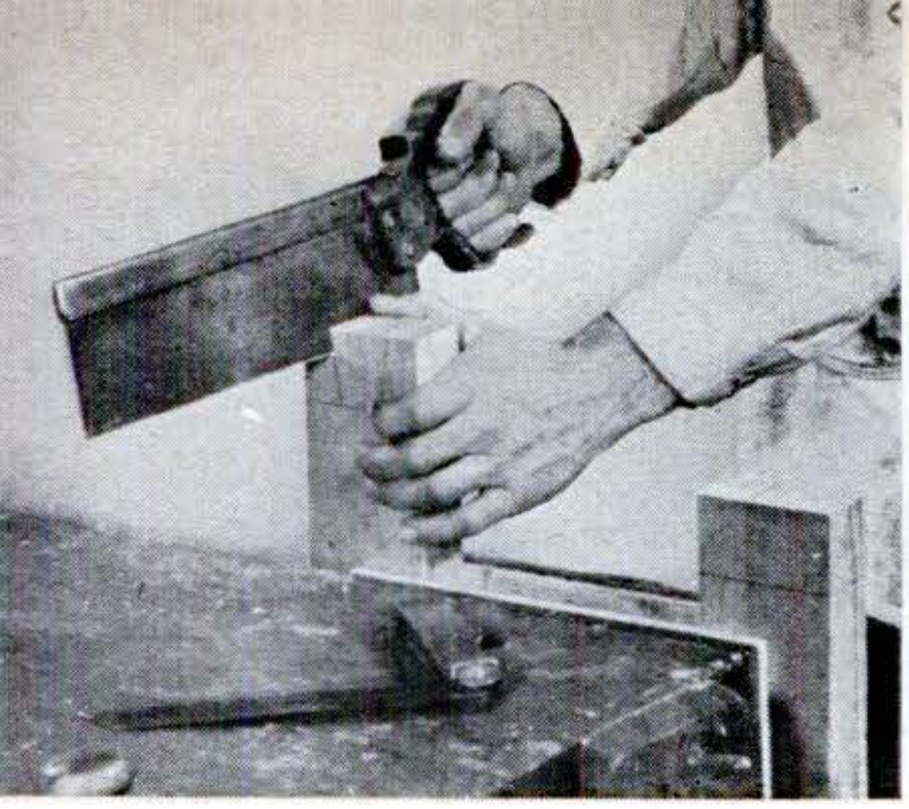
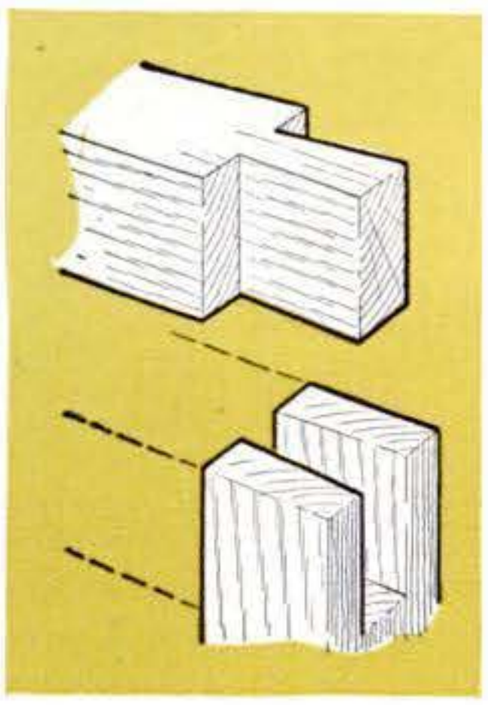


Start sawing out the pin from a near corner. Cut in the waste material, with the saw teeth grazing the line. After making the pin, use it to draw guide lines for the socket. It is ripped, then completed by chopping out the waste with a chisel. Wood blocks protect workbench from being scarred by chisel.

COMMON SINGLE DOVETAIL



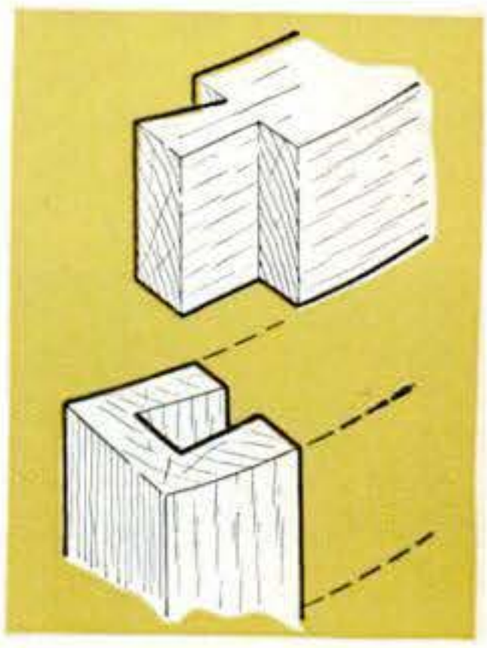
To MAKE this joint, true up the lumber and draw a fine pencil line around each piece as far from the end as the thickness of the one with which it is to be joined. This will locate the shoulders of the pin and the depth of the socket. This dimension can be increased 1/32″ if desired, so that there will be a slight projection of the ends to dress flush after assembly.

On the face of the pin member, divide the line into thirds, the center section being the width of the pin at the base. Next, draw the sides of the pins, sloping them 1″ in 6″ for softwood, or 1″ in 8″ for hard. Set your bevel square to this angle and press the stock handle against the end of the work. Finally, square the marks across the end and repeat the layout on the other side.

Clamp the pin piece upright and rip the sides with a backsaw. If the blade strays from the line at the back, reverse the piece. Then cut the shoulders.

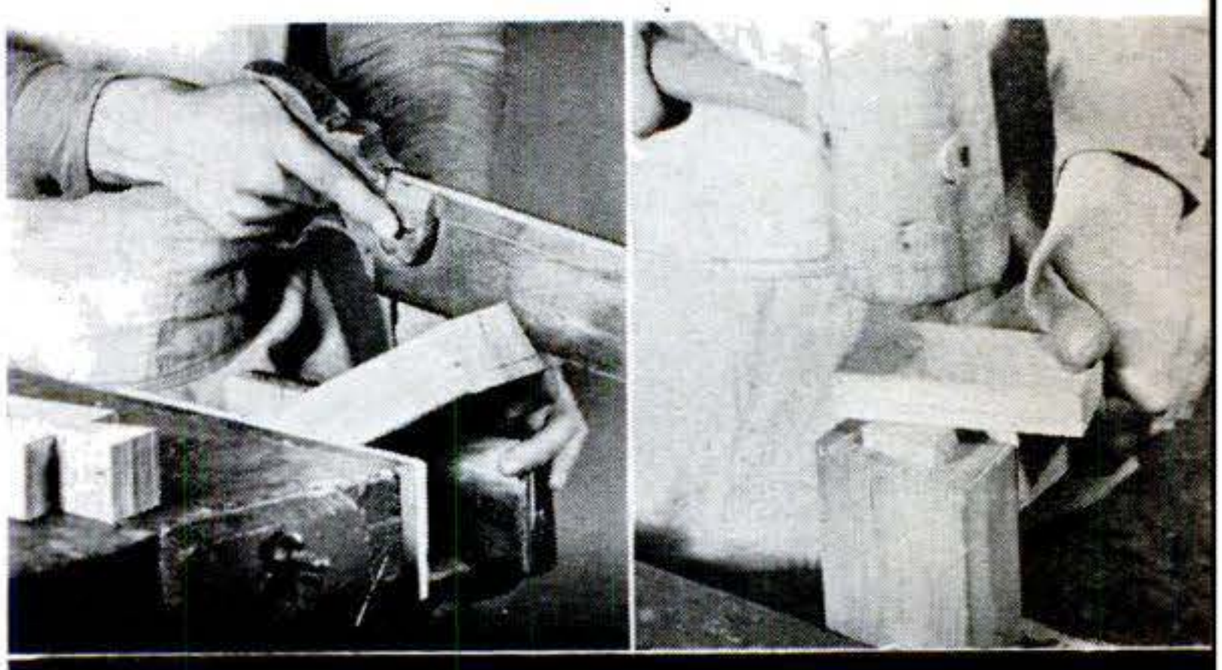
Next, clamp the socket piece upright in the vise. Rest the pin on its end, and scribe around it. This gives you a layout identical with the cut of the pin. Use a marking gauge to establish the side lines of the socket and saw them. Chisel out the socket bottom, making the first cut inside the line, and cutting half-way from each side.

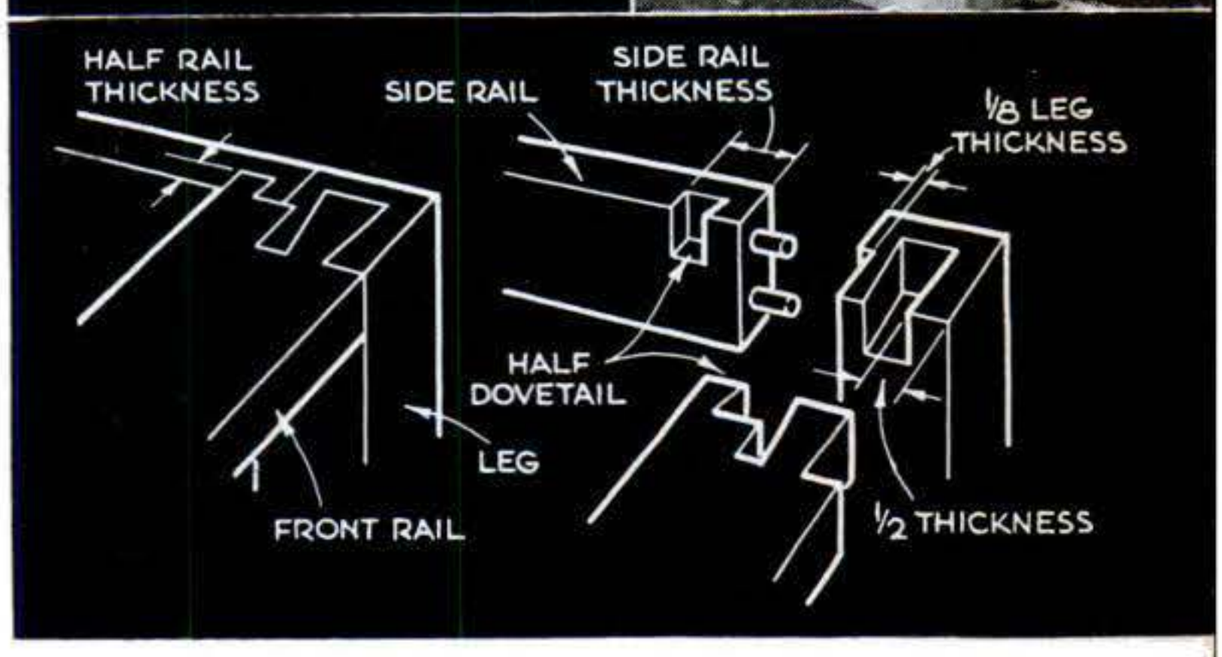
LAPPED DOVETAIL



To MAKE this joint, you proceed as though you were making a common dovetail. The pin is made shorter, however, so that it will not extend entirely through the mating piece.

To cut the joint, saw the pin as you would for a common dovetail. The socket, since it does not go through, can be sawed only to the diagonals of the sides. The rest of the excavation is chisel work—a combination of chopping the bottom, splitting the end, and trimming the sides. Pare the sides with the flat of the chisel. As the socket approaches size, try it out on the pin frequently to make sure that you don't cut it too large.

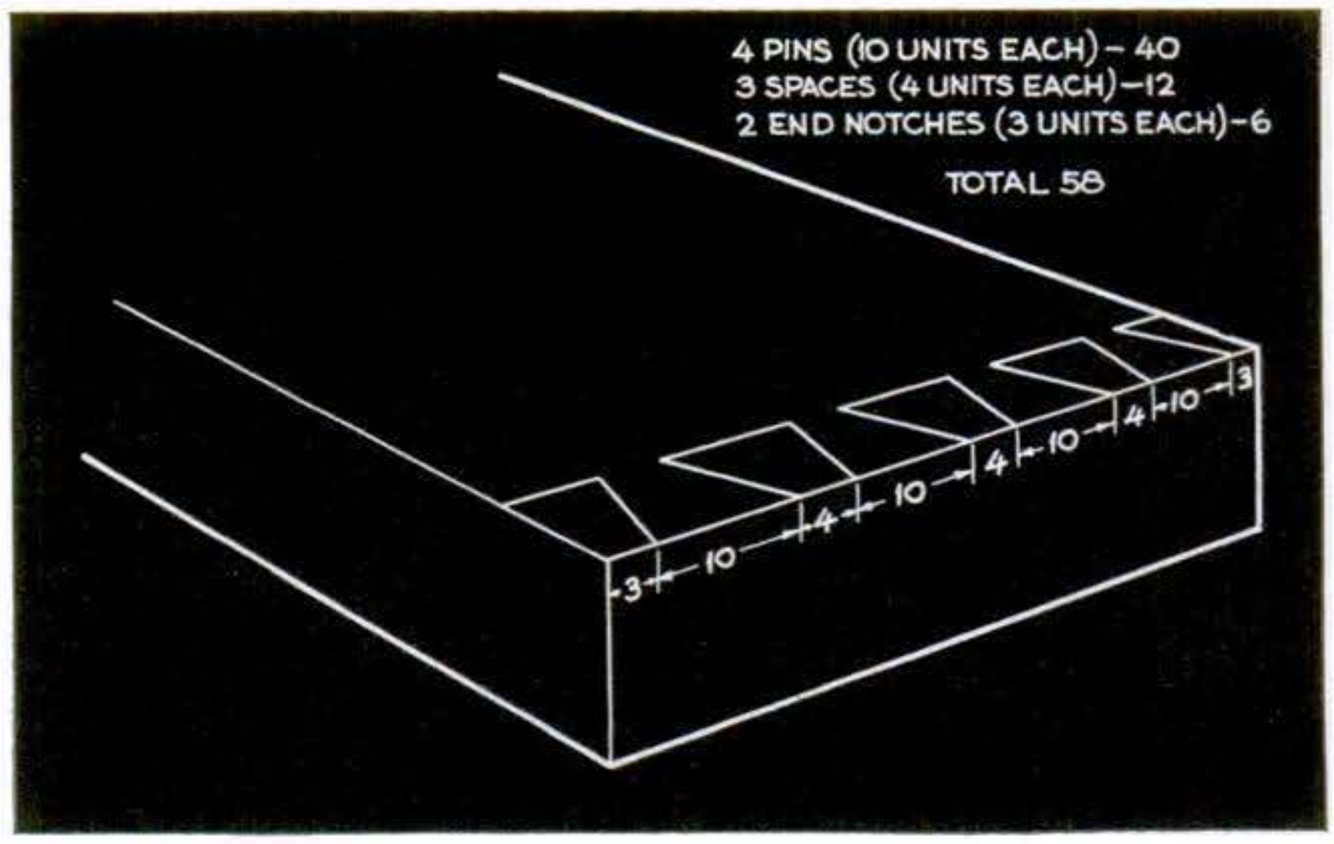


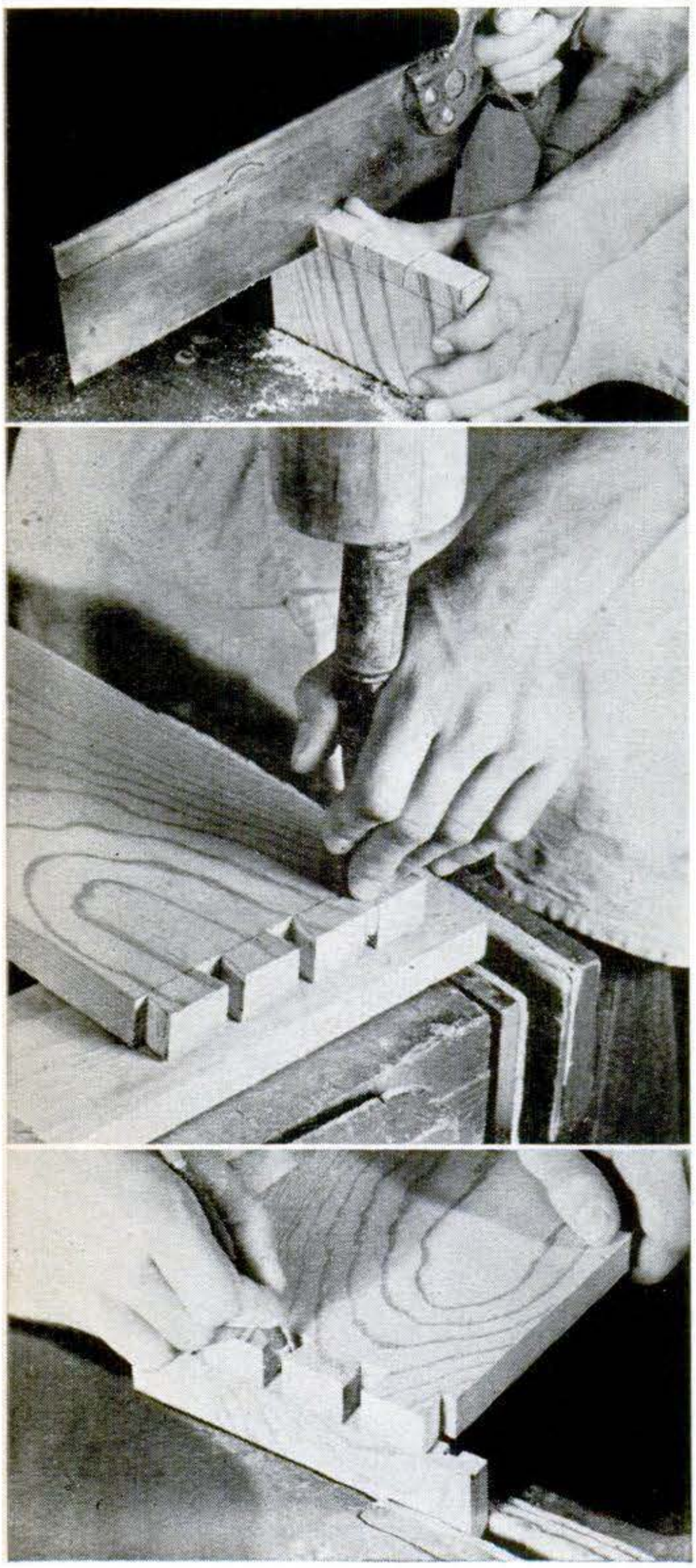


Sockets for lapped dovetails are sawed to the diagonal, and finished with a chisel. To assemble the joint, coat all joining parts with glue and knock together with a mallet or hammer and protecting block. Clamps are needed only at right angles to pin. Sketch shows how combination dovetails make solid furniture corners.

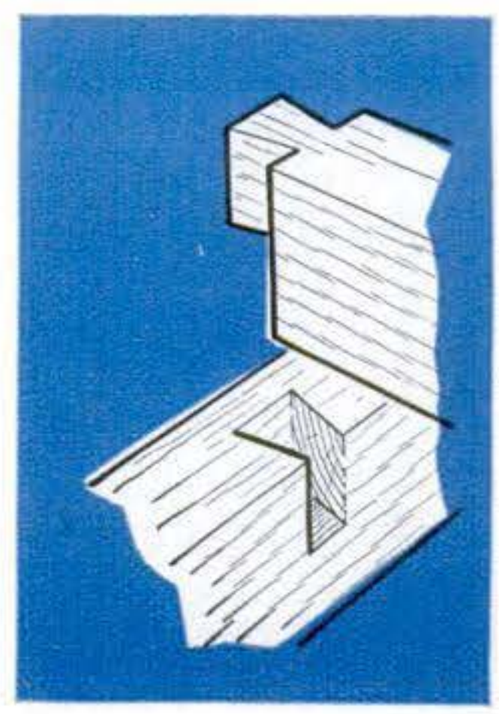
Copyrighted material

To space multiple dovetails, allow ten units for the width of the dovetail at the base line, four for the spaces between, and three for the edge notches. A back- or dovetail saw is then used to cut the pins as shown below. Waste is chiseled out with the chisel held as shown for nudging it into exact position. Light mallet blows will reduce pitting of the socket bottoms. Mortises are then scribed as indicated in bottom picture. Piece shown in photos is the back of a drawer, which is not as wide as the sides (see bottom photo below). Bottom of drawer can then be slid into grooved sides after assembly.





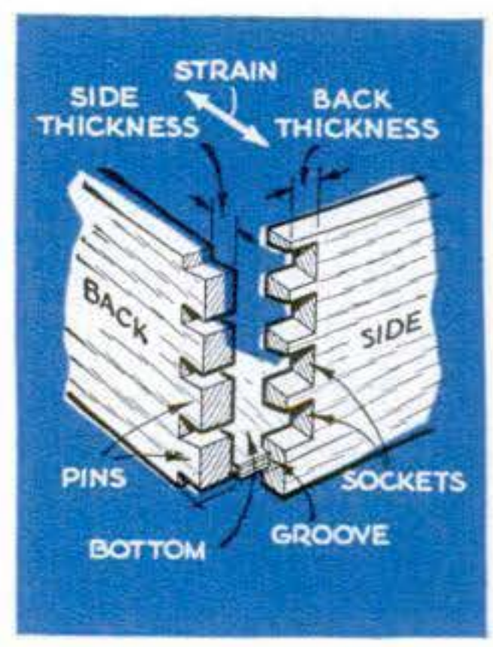
HALF-LAP DOVETAIL



THE end of the pin member for a half-lap dovetail is first cut as it would be for a plain half-lap joint, by ripping down the middle. Then cross-cut from the edge to form the shoulder. The pin is cut on the remaining stub.

Scribe it on the face of the mating member, if the joint is a tee, or on the end of that piece, if a corner joint. Gauge a line to locate the depth of the socket in the tee, or square a line for the corner joint, and excavate the socket. The pin may extend through the joining piece or may be so short that it is "blind"—which means, in this case, that it is concealed. This joint is often used in drawer-rail construction.

MULTIPLE DOVETAILS



THESE are simply rows of single dovetails. A spacing problem arises, however, and the pins usually are made considerably wider than the spaces between (see photos at left).

Mark the sides of the pins, square them across the ends of the pieces, and saw the pin sides. Two or more pieces often can be

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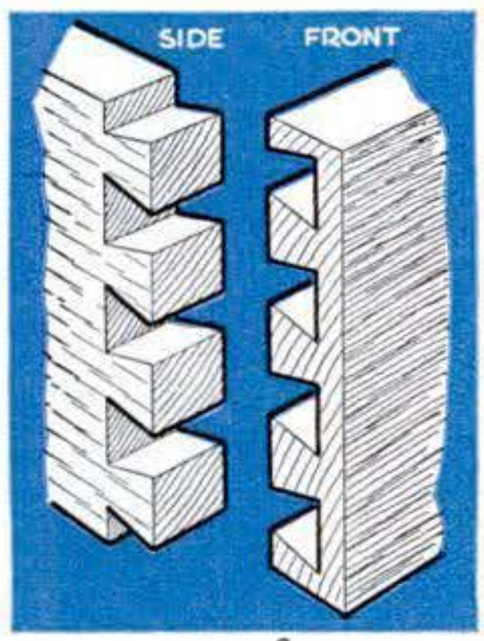
clamped together for sawing, to save time. Then, after scribing the ends of the joining members, rip and chisel the sockets, using a backsaw or the smaller version of such a saw known as a dovetail saw.

In chests, the pins usually are made on the ends, and in drawers on the sides. There is good reason, however, to make them on the drawer back, if dovetails are used there, because this makes it impossible for the drawer to spread and lock itself shut.

Carpenters sometimes disguise poor fits by making over-length pins and "bishoping" or riveting them down to fill the looseness. While this is frowned on by many craftsmen, a better job may result than if the joints were left open, since glue can penetrate well.

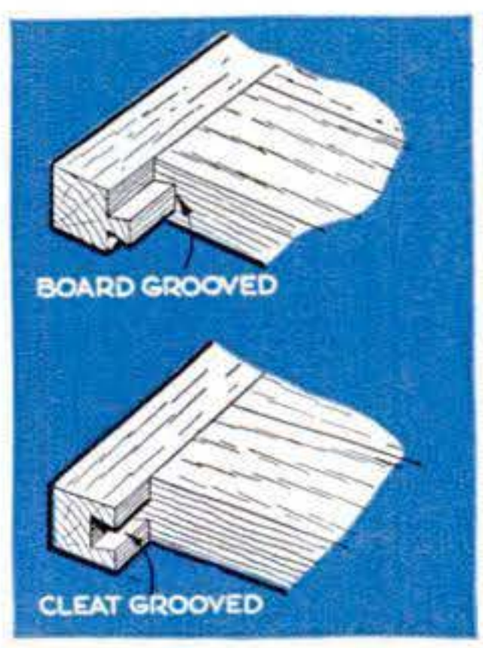
HALF-BLIND JOINT



HALF-BLIND or lap dovetails are made for such purposes as joining the sides of a drawer to the front piece.

Make the pins two-thirds as long as the front piece is thick. The routine is otherwise the same as for other dovetails. Since the front of a drawer must be fitted into the opening it is to occupy when the furniture is assembled, the ends should be rabbeted from 1/16″ to ⅛″ deep, and the sockets worked in the rabbets.

DOVETAILED CLEAT

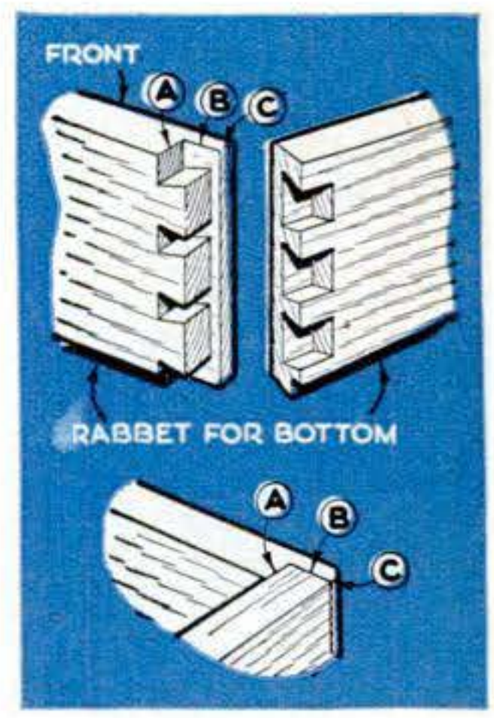


THE dovetail pin may be made either on a cleat or the board to which a cleat is to be fastened. If the pin is on the cleat, the sides and shoulders can be cut with a rip saw. A strip of wood tacked along the marking line can be used to guide the blade. The shoulder also can be cut with the help of such a fence. Or, you can rabbet the edges and chisel the tongue into a dovetail section. A cleat used for a drawing board should be of hardwood, and should be the grooved part.

HOUSED DOVETAIL

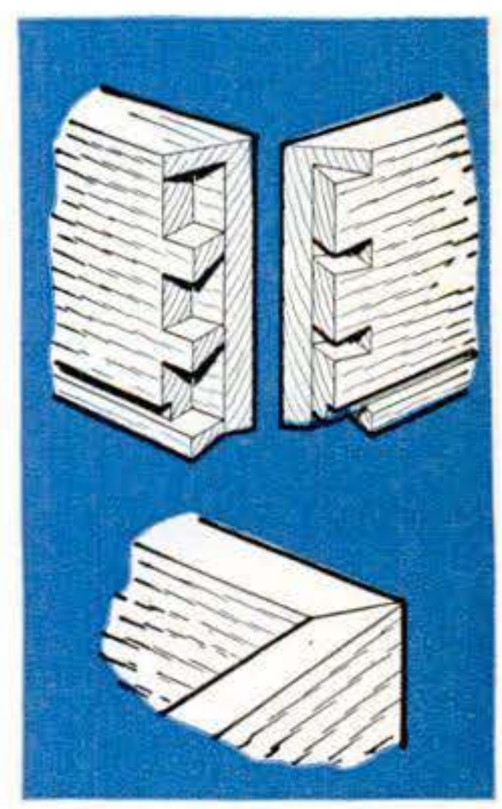
A DOVETAIL pin can be cut on the end of a shelf by cross-cutting the shoulders on opposite faces and paring the slopes with a chisel held bevel-down. If the pin is to be a thin one, rip the sides and cut the shoulders afterwards. Make the socket like a conventional dado, but saw the sides at an angle and add a center kerf to prevent chips from wedging as they are chiseled out.

BLIND SQUARE-LAPPED DOVETAIL



THIS is one of the secret dovetails. Sketch shows how it conceals the end grain of a drawer side. The front is the pin piece. The lip (C) that hides the grain is about a quarter of the thickness of the piece. Rabbet the end of the pin piece to form this lip, then lay out the pins on the rabbeted end and inner face, and the sockets on the end and inner face of the joining piece. Saw the sides of the sockets to the diagonals and chisel out.

BLIND MITERED DOVETAIL



THIS is another secret dovetail. It is simply a blind square-lap joint in which both joining pieces are rabbeted and a miter is made on the outer part.

Next month Mr. Love will tell how to make dovetails with circular saw or drill press.

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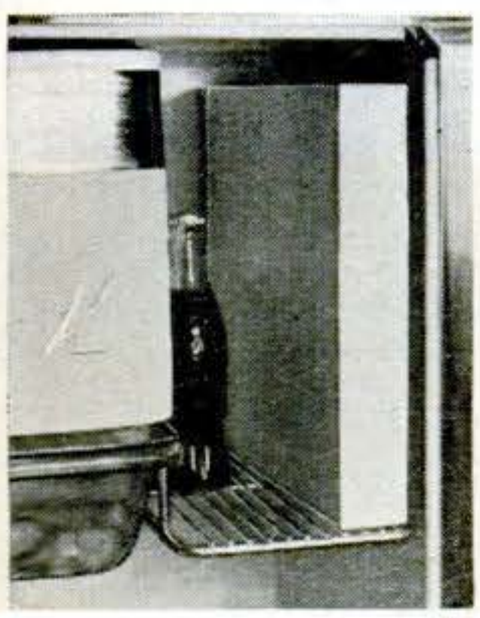


Coiled copper tubing inside a water-filled compartment in refrigerator chills water from the regular pipes as fast as you use it. Two holes, drilled through refrigerator walls, are made to fit the tubing tightly. To replace water that evaporates from the open tank, use a small syringe.

Single-hole installation draws water from can you refill. Restaurant-type faucet is set into ¾" hole below tank outlet. Cement lining in hole strengthens wall, prevents buckling.

Want Ice Water on Tap This Summer?

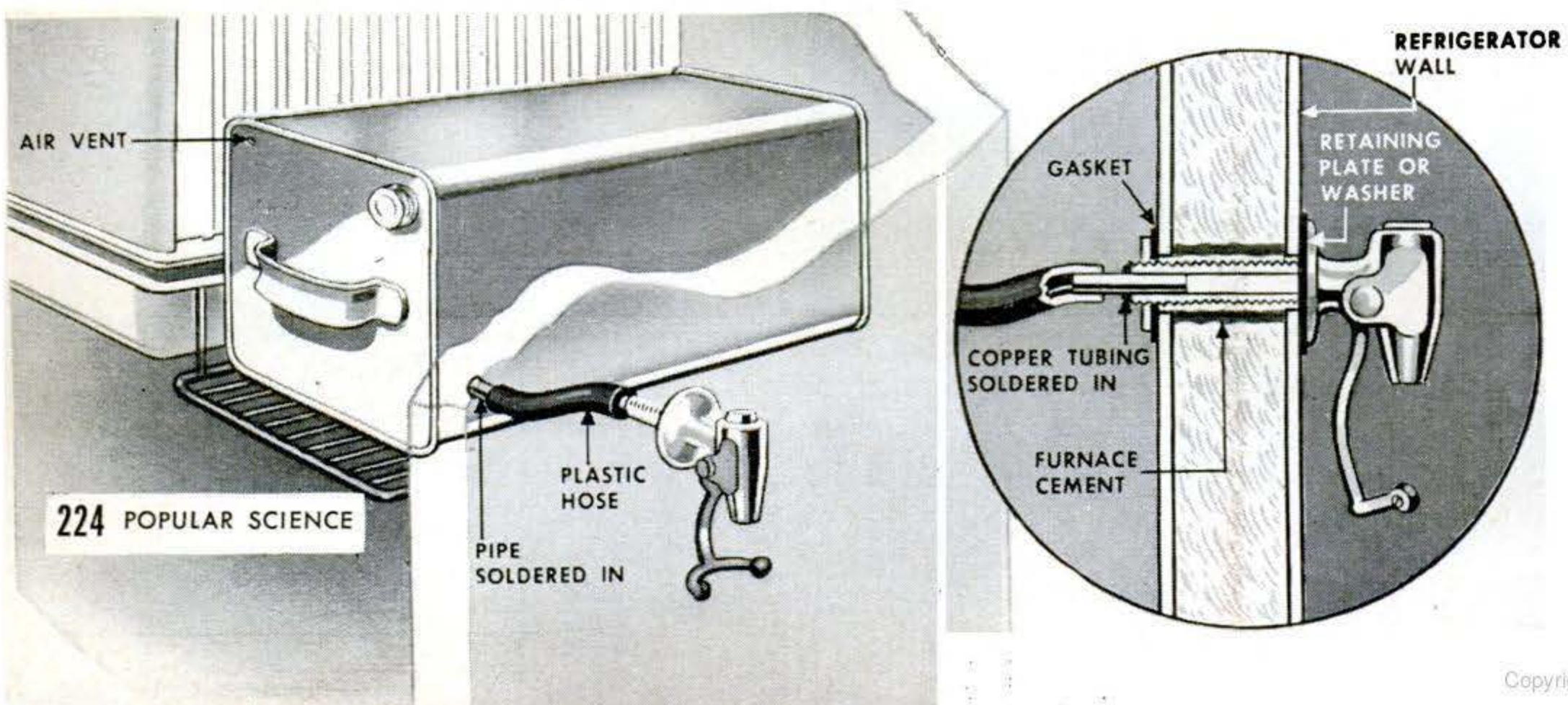
Here are two ways to get it.

RUNNING ice water sounds de luxe—and it is. It's also one of the most economical luxuries you can name. You save all around when you draw cold water from a tap without opening the refrigerator door:

- You save water: No need to run it till it gets cold. In many water-short communities this is a matter of top importance.
- You save money: Frequent opening of a refrigerator door to get the water jug adds a stiff premium to your bill and makes it necessary to defrost the box more often.
- You save time: No fumbling or waiting when you want a cold drink.

It's not difficult to install a refrigerated tap, as two POPULAR SCIENCE readers have demonstrated. The photos and drawings at the upper left show a continuous-supply system built by Kent Bellah, St. Jo, Texas. It draws water from the house pipes and runs it through 25 feet of coiled copper tubing encased in a sheet-copper cooling tank. Cold drinking water comes out a spigot set into the wall of the refrigerator.

A different method, suggested by Norbert Koenig, Cincinnati, Ohio, requires no attachment to the house pipes and only one hole in the refrigerator. Water is drawn from a can or jug kept inside the chest. The 2-qt. syrup can shown below has air vent and outlet holes drilled in it. Pieces of copper tubing are soldered to the outlet and to the inlet pipe of the faucet. The two tubes are joined by plastic or gum-rubber hose.



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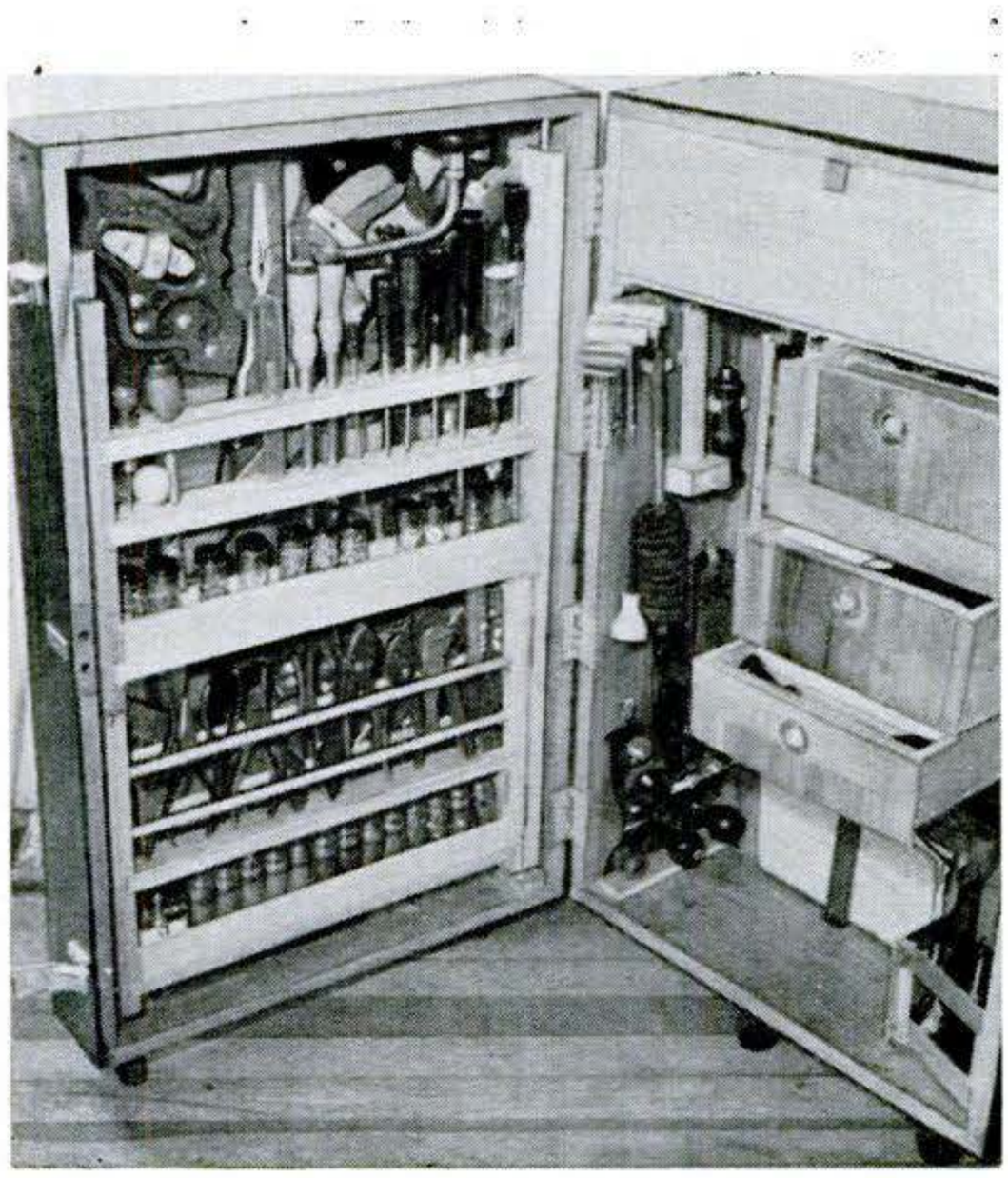
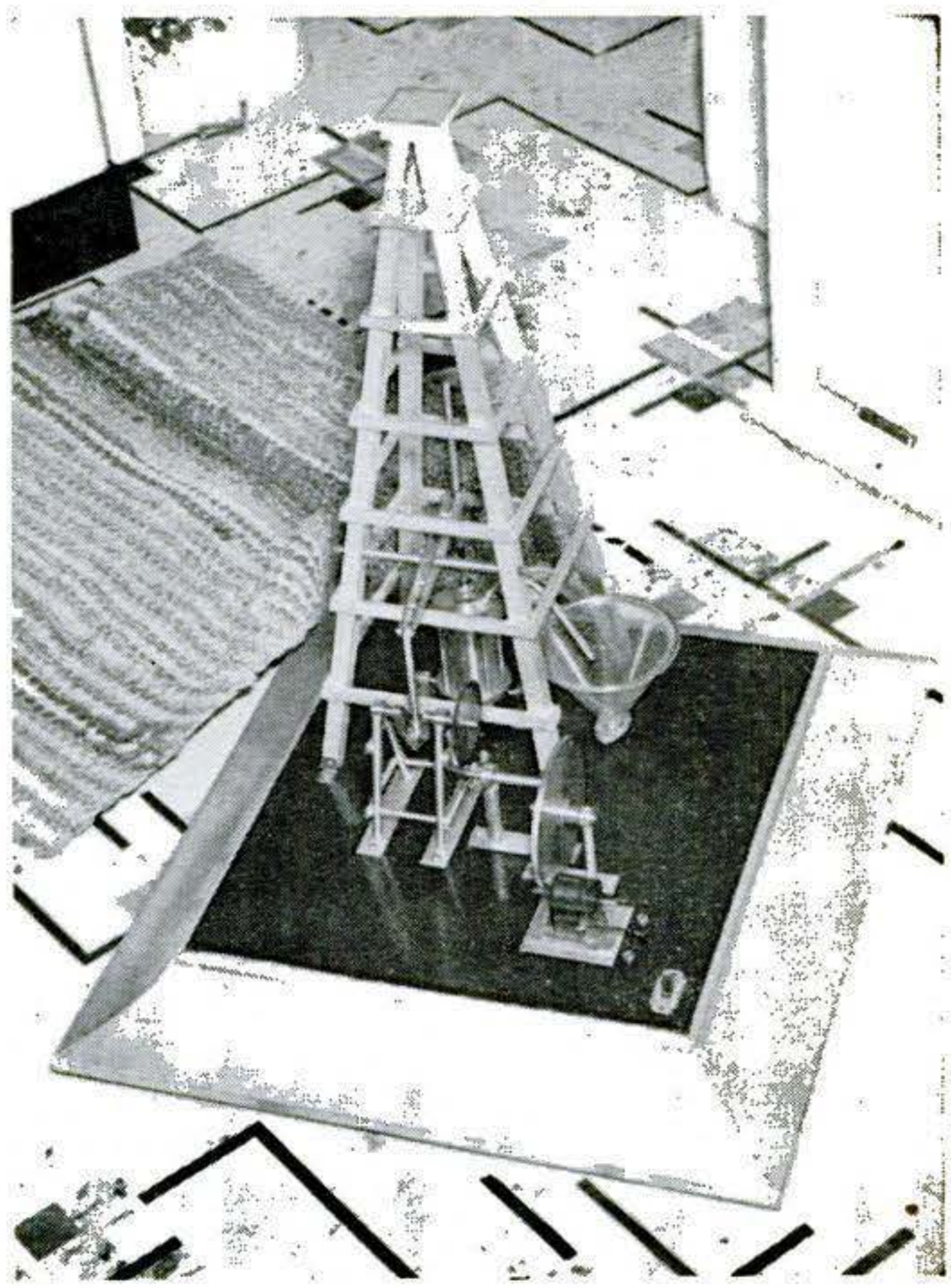
CRAFTSMEN AT WORK

Junior Tractor for Junior. Ross W. May, of Acampo, Calif., built this half-size model of a tractor for his son. It's the spittin' image of the real thing. A 1¾-hp. Briggs and Stratton engine supplies the power. The transmission is a two-speed one taken from a motor scooter. A drum-type brake on the rear axle is operated by a hand lever. Tires on the rear wheels are 6.00 by 16; those on the front wheels are 4.00 by 8.



Apartment Tool Chest. Hand tools and supplies—from nails to sandpaper—are stored in this chest built by M. B. DuBord, of New York City, for use in his small apartment. Dimensions are 13½" deep, 24" wide, and 34" high. It rolls on six rubber-tired casters. Sections of the chest swing out so various tools will be more accessible. The three drawers of different depth offer additional space for small tools.



Model Rig Pumps Liquids. Art Rosatti, of Rock Springs, Wyo., built this motor-driven model of an oil rig that really pumps liquids. All metal parts, except gears, were machined from bronze or brass. Rig is mounted on a wooden base.

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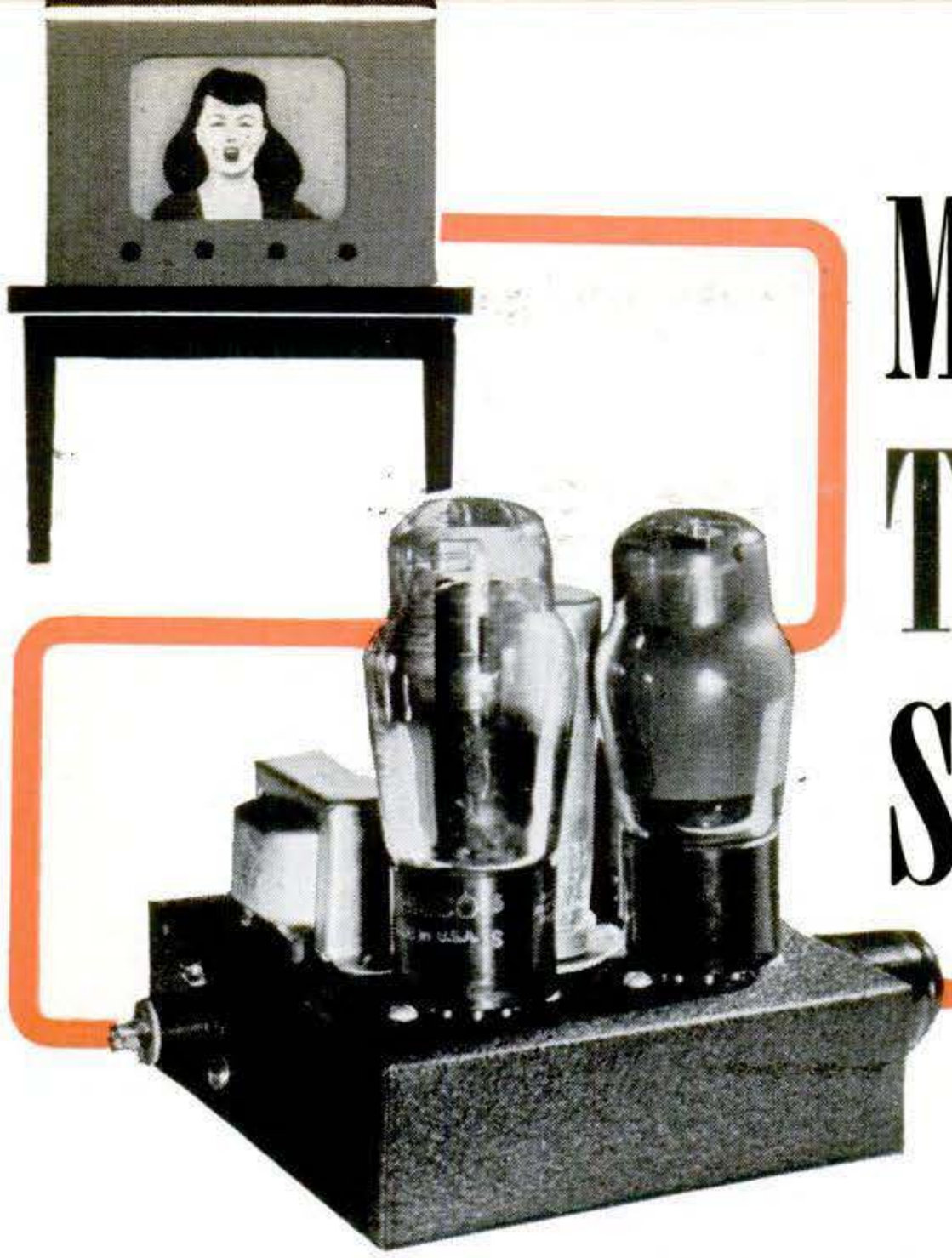


Make TV Pictures Sound Better

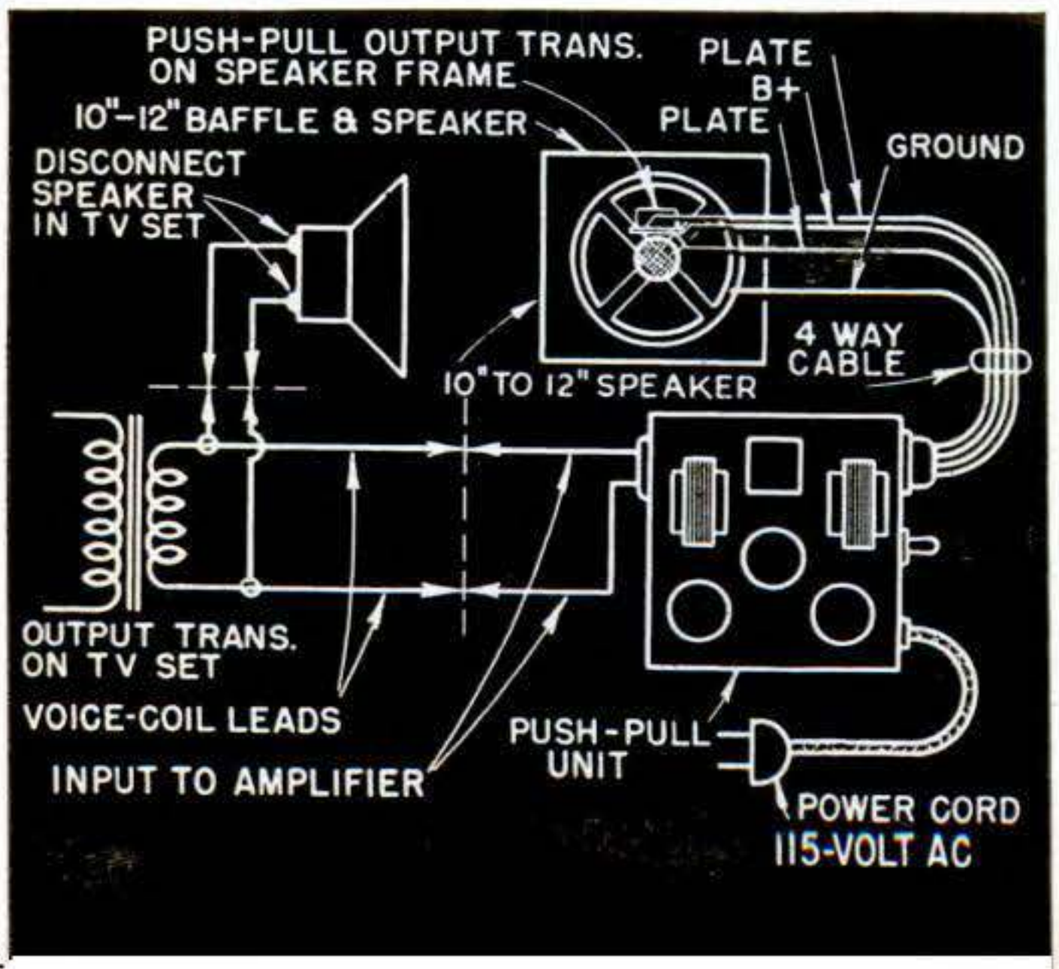
This push-pull stage can be hooked to any receiver. It by-passes the tiny speaker, takes advantage of set's FM sound.

PULLING pictures out of the air seems to have dulled the ears of many Americans to the sound accompanying those pictures. If you look inside a table-model teleset, you'll probably see a 3- to 5-inch loudspeaker fed by a single output tube—just about what you'd get in a cheap AC-DC radio.

But TV sound *can* be first-rate. It is broadcast by FM and the receiving circuits usually are well designed.

You can make better use of the sound potential of your TV set by building yourself the 9-watt push-pull output unit pictured above. It can be attached to any receiver without tampering with the wiring. To obtain the best results, however, you should use it with a 10- or 12-inch speaker in a separate baffle.

Speaker of set is disconnected at voice coil. The two wires are brought to the output stage.



Keeping the unit compact makes it easier to mount in or near the video cabinet. It takes some squeezing, but as you can see from the photos, all the parts will fit a chassis 5″ square and 1½″ high.

Though only two tubes are visible, the circuit is actually a three-tube plus two-rectifier affair. There is one 6F6 and one 6AD7-G. The latter is a dual tube containing the equivalent of a 6F6 pentode plus a triode phase inverter. Two dry-disk selenium rectifiers in a voltage-doubler arrangement supply nearly 250 volts for the plates of the amplifier tubes.

To minimize tampering with the television receiver, the sound signal is picked up at the secondary (voice-coil) winding of the teleset's output transformer. This means that only two wires have to be disconnected at the set. It also means that a shielded intercom transformer is needed to match the low-impedance output of the set to the input of the push-pull unit. Both primary terminals of T1 must be insulated from the chassis.

In wiring, watch the grid and plate leads. Make them as short as possible. If they must stretch over an inch, use shielded wire and ground the braid to the chassis. Work on the heater connections first, and then do the remaining tube-socket wiring. Rectifier and line circuits can be put in last.

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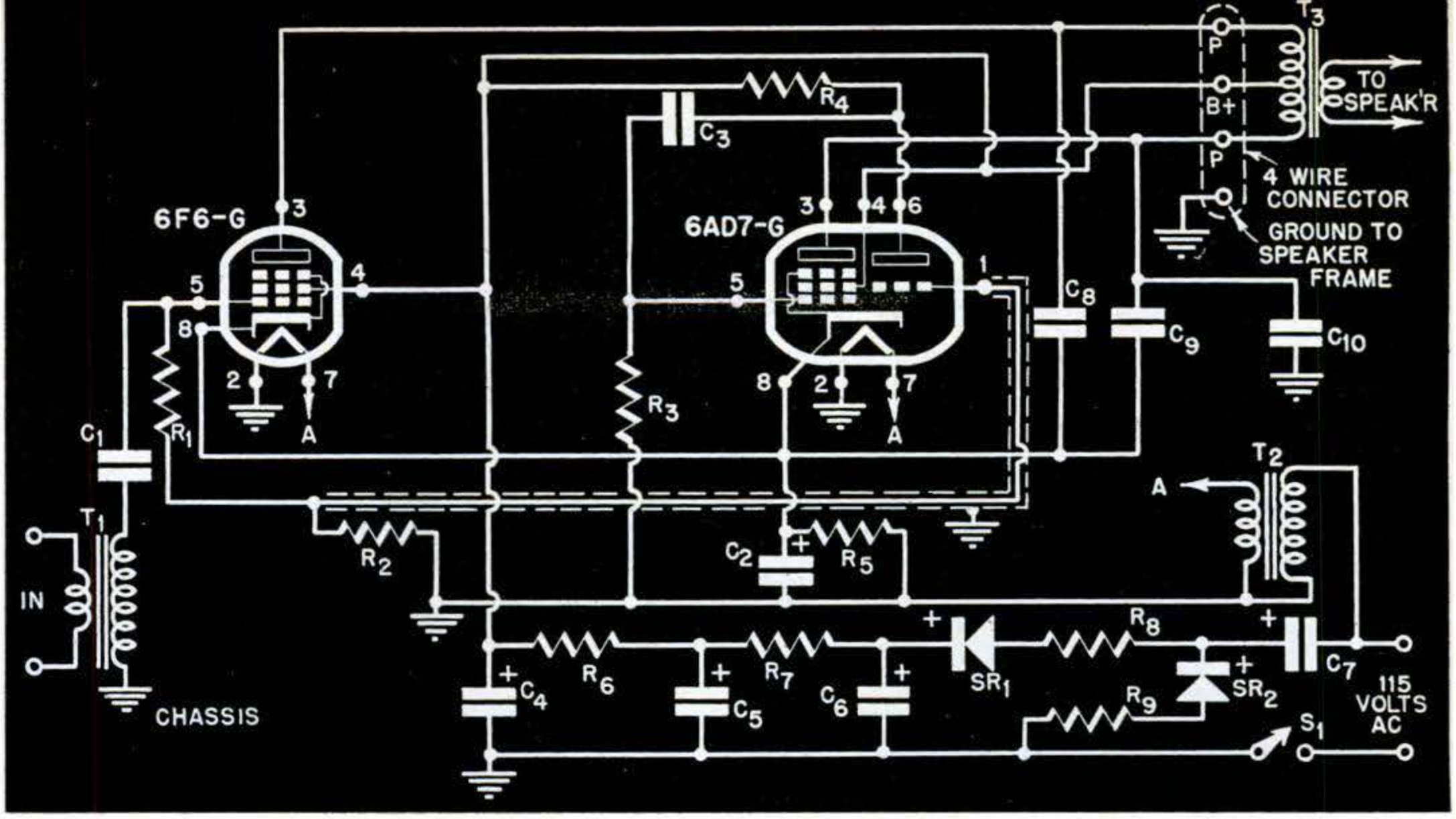


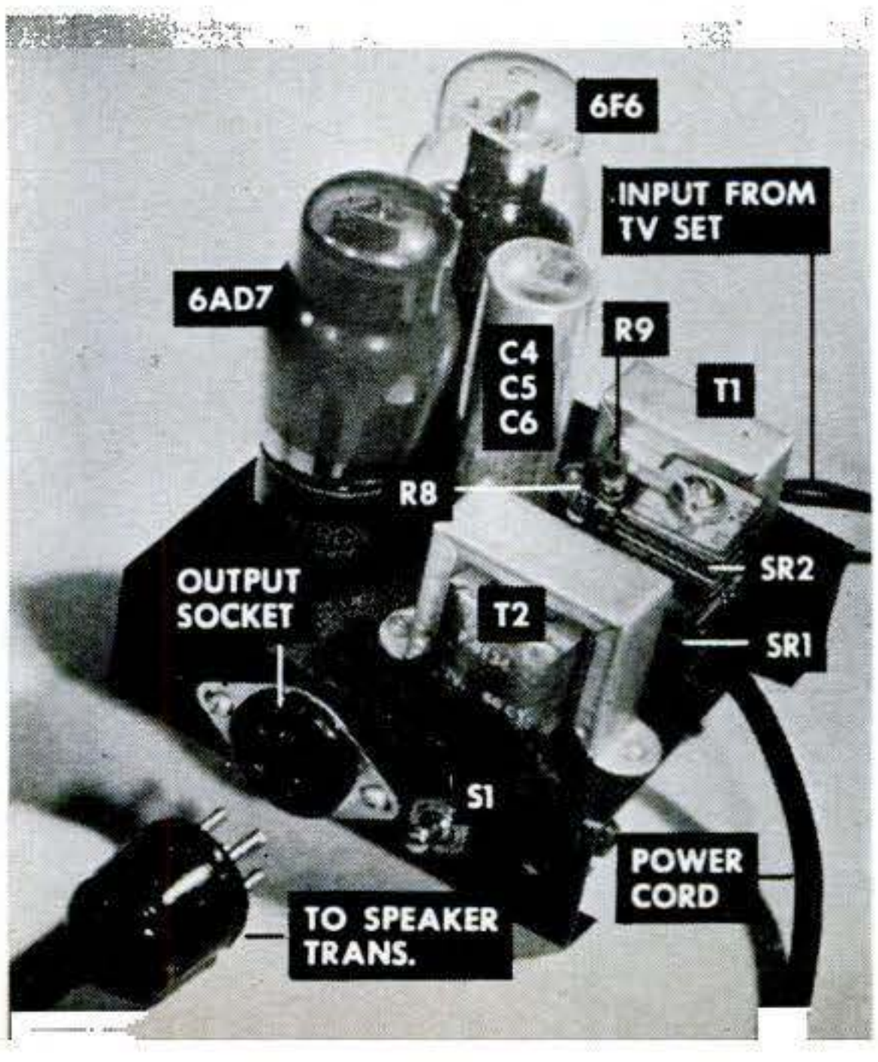
LIST OF PARTS

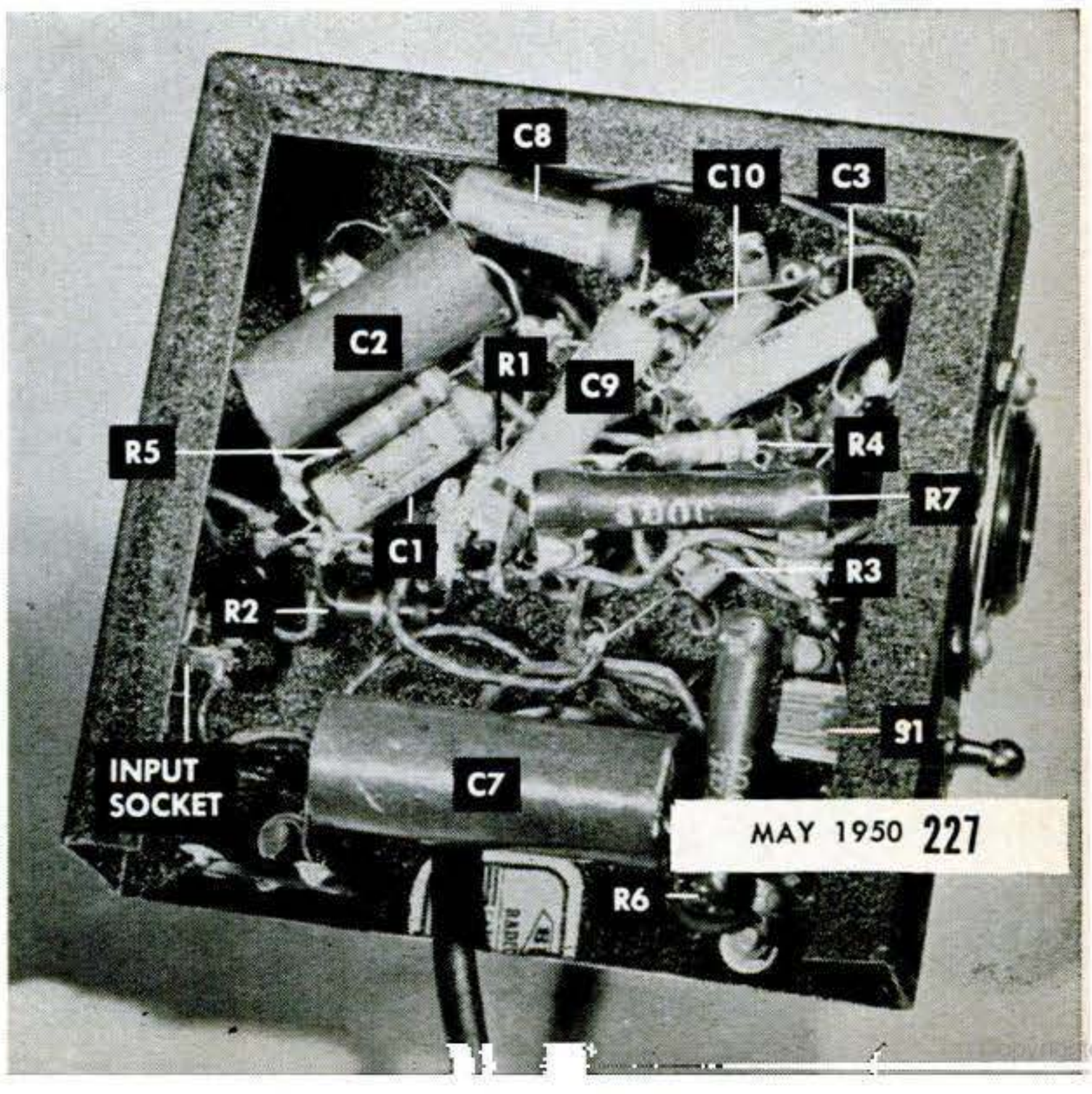
R1: 330,000-ohm, ½-watt carbon.
R2: 100,000-ohm, 1-watt carbon.
R3: 470,000-ohm, ½-watt carbon.
R4: 33,000-ohm, 1-watt carbon.
R5: 600-ohm, 2-watt carbon.
R6: 500-ohm, 10-watt wire-wound.
R7: 1,000-ohm, 10-watt wire-wound.
R8, R9: 47-ohm, 1-watt carbon.
C1: .01-mfd., 400-volt paper.
C2: 10-mfd., 50-volt electrolytic.
C3: .005-mfd., 400-volt paper.
C4, C5: 10-mfd., C6: 20-mfd. Triple unit, 450-volt elect., or single units.
C7: 30-mfd., 150-volt elect.
C8, C9, C10: .01-mfd., 400-volt paper.
T1: Shielded intercom transformer, 4-ohm pri. to 25,000-ohm sec.
T2: 6.3-volt, 1.2-amp. filament transformer.
T3: 10-watt universal push-pull output trans.
S1: SPST toggle.
SR1, SR2: 100-ma. dry rectifiers.
Shielded jack or terminals (for input), 4-prong socket and plug (for output), tubes and sockets, 10" to 12" speaker and baffle, misc. hardware.

To eliminate the high-pitched, frequently scratchy tones you often hear on the sound tracks of old TV movies, condensers C8, C9, and C10 have been used to "mellow" the tone. You may find that they cut too much of the treble for your taste. If so, disconnect C10 or reduce the value of C8 and C9 from the .01 mfd. specified to about .005 mfd.

A 4-prong socket is flush-mounted at one end of the chassis and a matching plug and length of 4-wire cable are used to make connection with the primary of the output transformer. The transformer can be mounted directly on the frame of the new speaker. A universal type is recommended because it provides a choice of impedances that simplifies proper matching. There are several taps on the secondary. Connect the speaker voice coil to any two of these, and then try all combinations till you find the two taps that give best results. Solder the voice-coil leads to these taps. END

Compact chassis requires careful arrangement of parts. The dry disks, placed one above the other, are held to chassis with a 2" machine screw.





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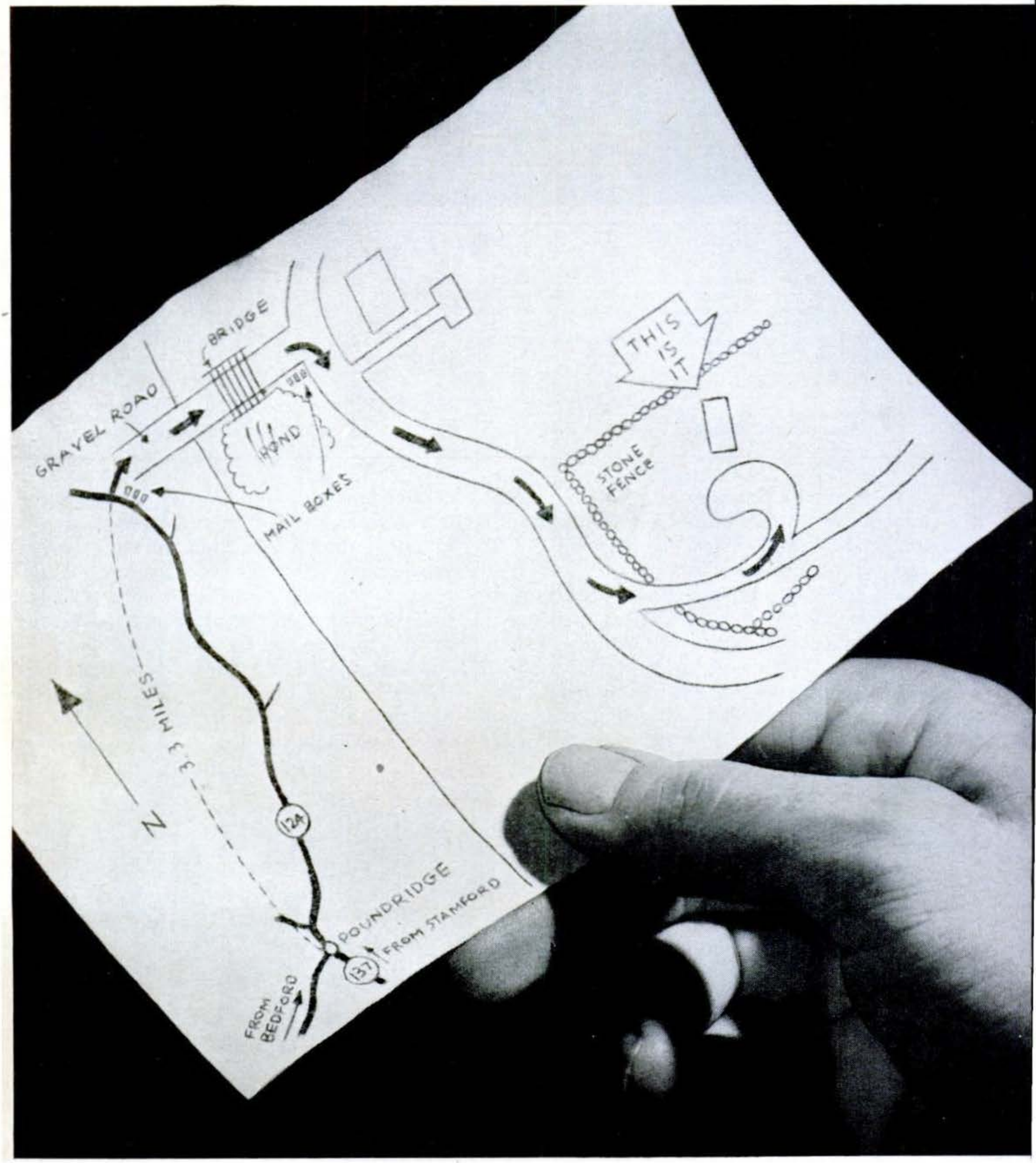
Print Your Own Road Map

WANT to direct visitors to your house without once gesturing or saying "You can't miss it"? Give them a photo-print map made from a carbon-paper negative.

The essential gimmick is a fresh sheet of one-shot carbon paper, the kind used in sales books. Typewriter carbon won't do. After you've drawn your map on thin paper, tape the carbon paper underneath, ink side down, and trace over the lines. Having lost carbon, the lines on the carbon-paper negative will be less opaque than other areas.

Set aside the map and clamp the negative in a photo printing frame with either con-



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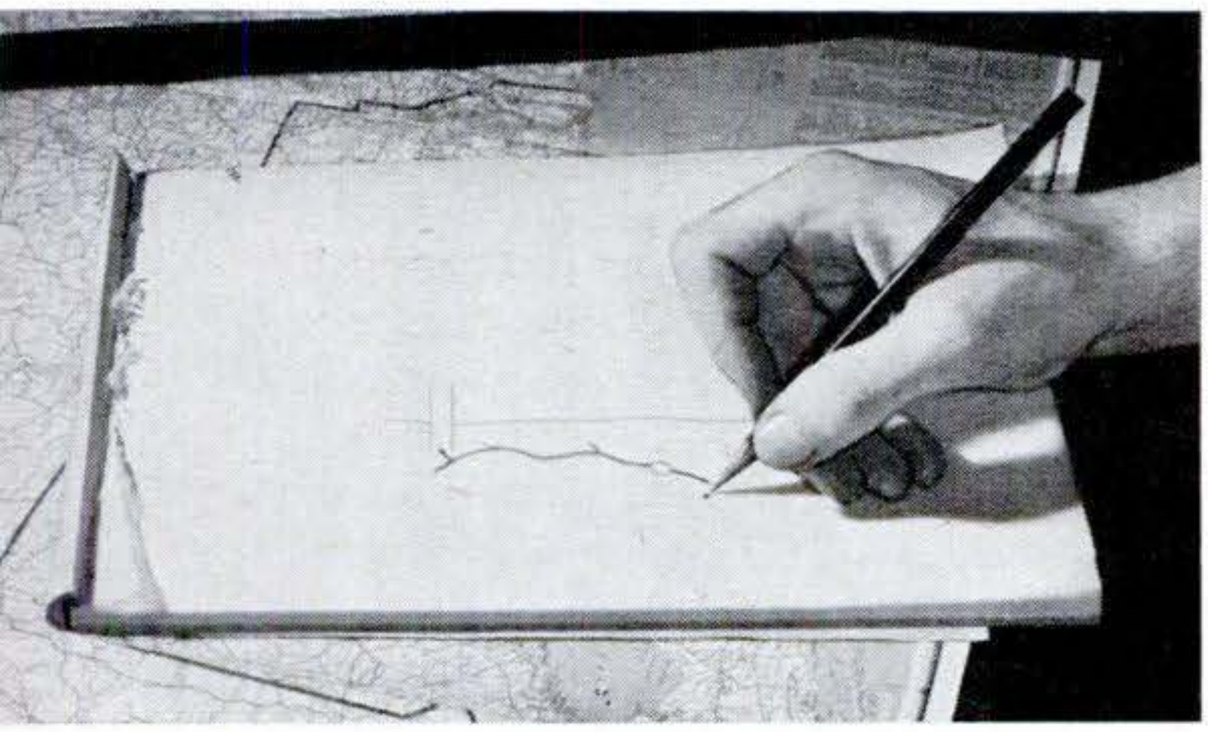
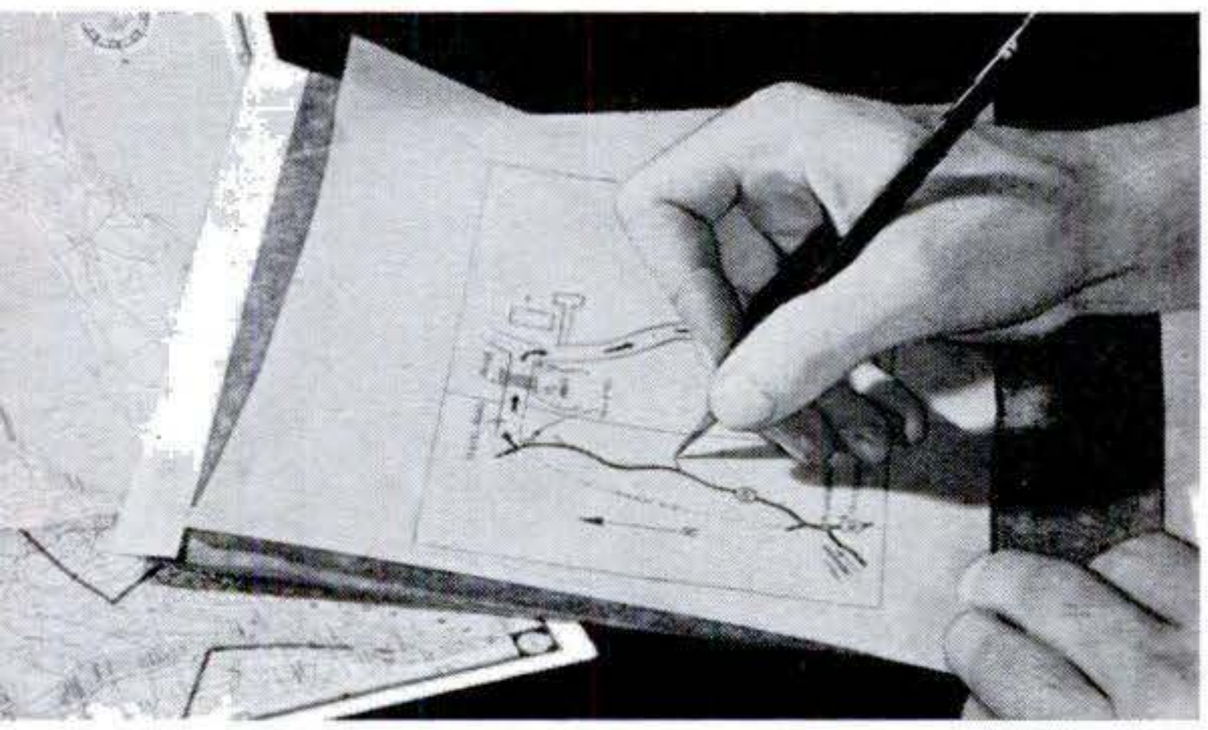
tact or projection printing paper, or lay the paper on a flat surface, put the negative on top, and weight with glass. Expose to light, develop, and fix like any photo print.

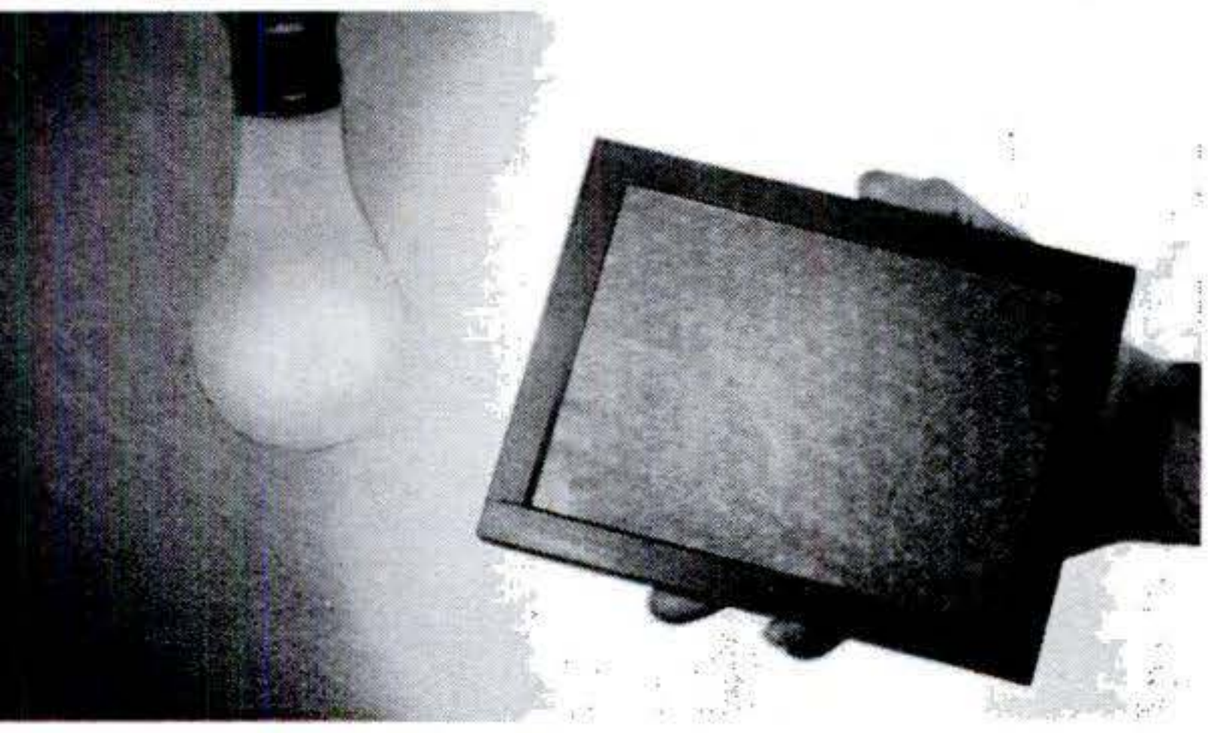
By cutting an opening in the carbon negative and taping a snapshot negative in it, you can simultaneously print a picture of your house on the map for identification.—*John V. Twyman, Los Angeles.*

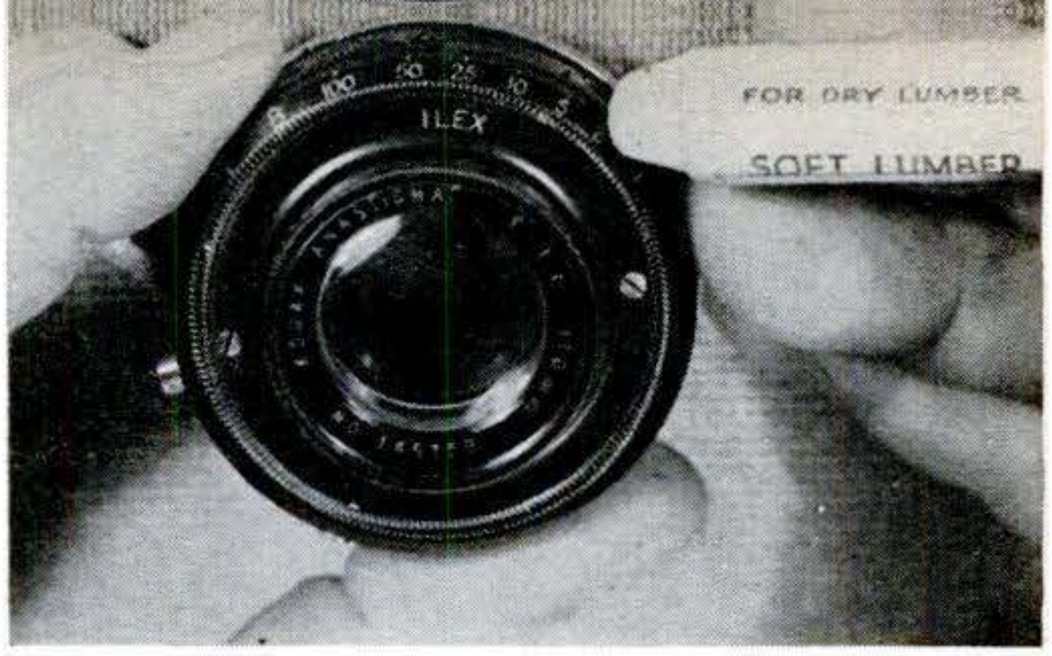


Sketch map on drawing tissue or thin paper. A road map, your own familiarity with the countryside, and actual speedometer readings will help with the job.



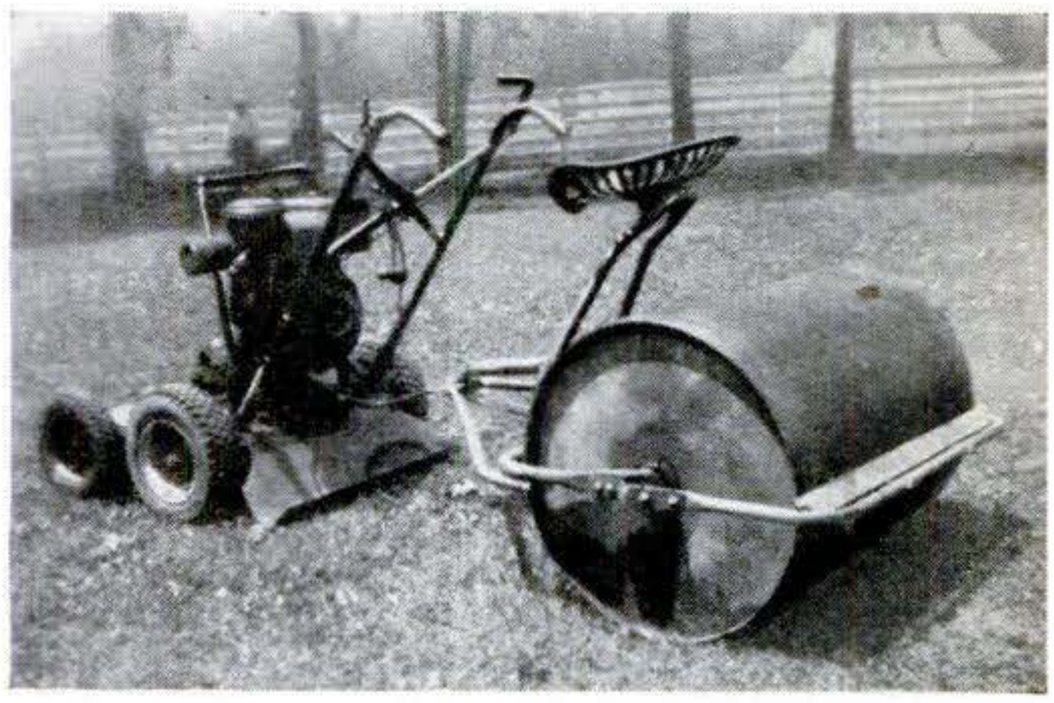
Slip carbon paper, ink side down, under the sheet and trace over map with hard pencil. In printing (below) inked side touches the photo paper. Make tests for exposure.





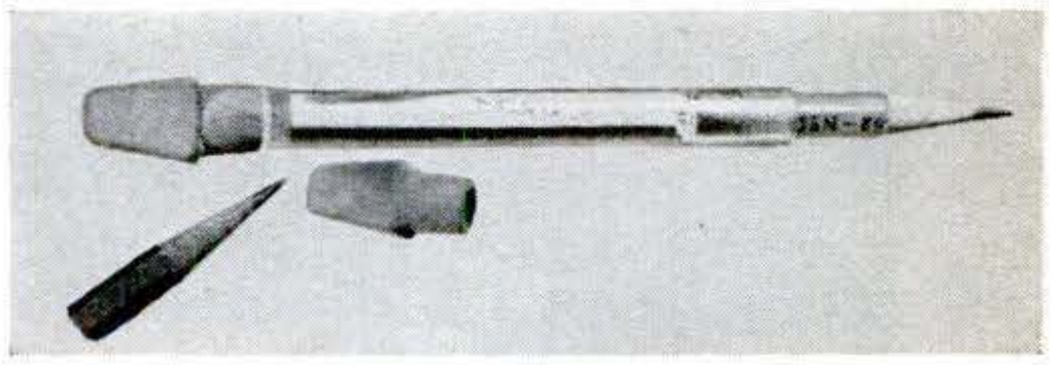
Crayon Renews Lens Markings

IN TIME the markings on camera lenses often become illegible. Rubbing a crayon over the surface and then removing the excess will fill the markings and make them like new.— *Frank Caporael, Westbury, N. Y.*



Mower Pulls Seat and Roller

THIS roller-seat arrangement was devised by John Schicker, of Strongsville, Ohio, to take some of the work out of mowing his large lawn. The frame, ¾″ pipe and 16-gauge tubing, is built around a lawn roller. The 5½-hp. engine that powers the mower easily pulls the roller and operator on fairly level ground.



Holder for Stubby Pencils

THIS holder for pencil stubs was made from a plastic rod. Ordinary ⅜″ dowels will serve just as well. If you use a dowel, wrap two or three layers of cellulose tape around the end you drill to keep the dowel from splitting. Use a 9/32″ drill and make a hole about ¾″ deep in one end of the rod. The eraser can be bought at a dime store.—*Joseph F. Gréce, New York City.*

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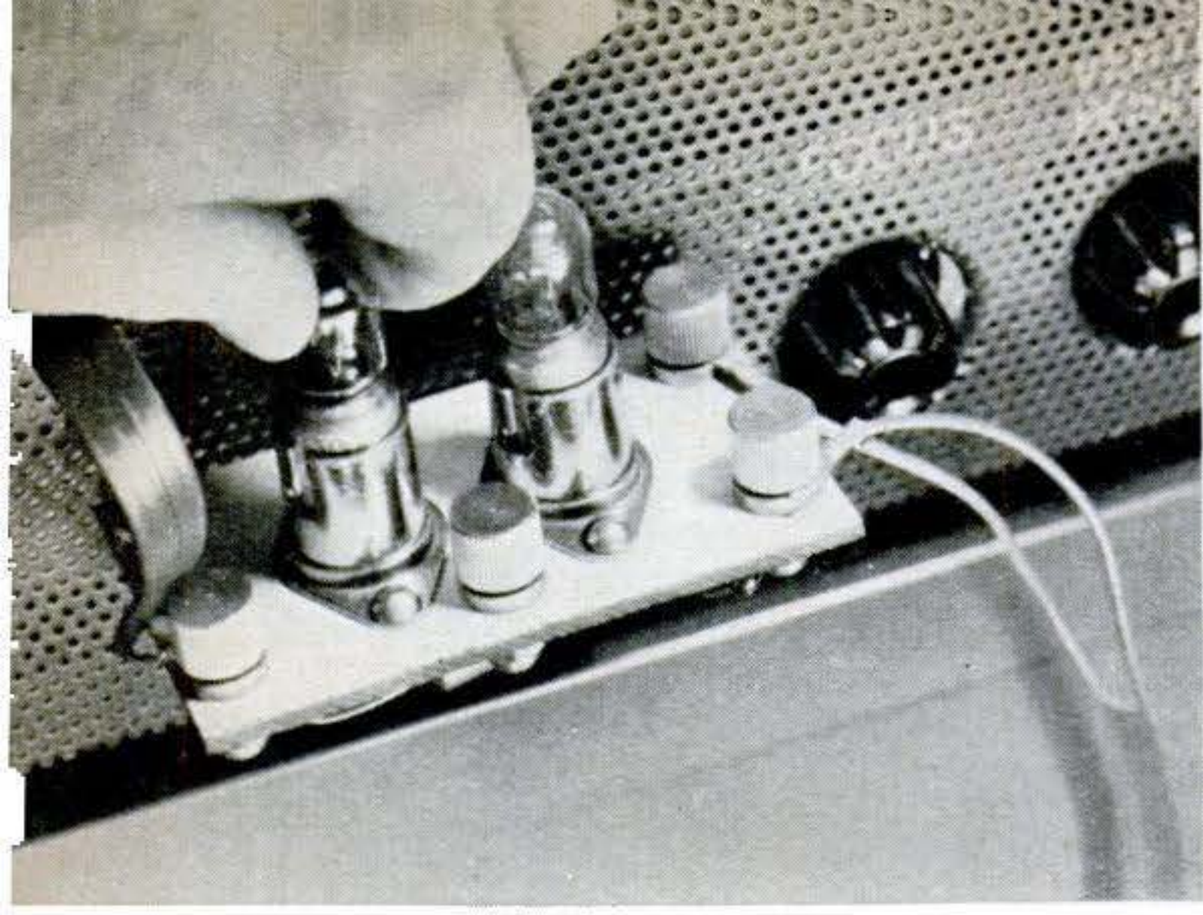
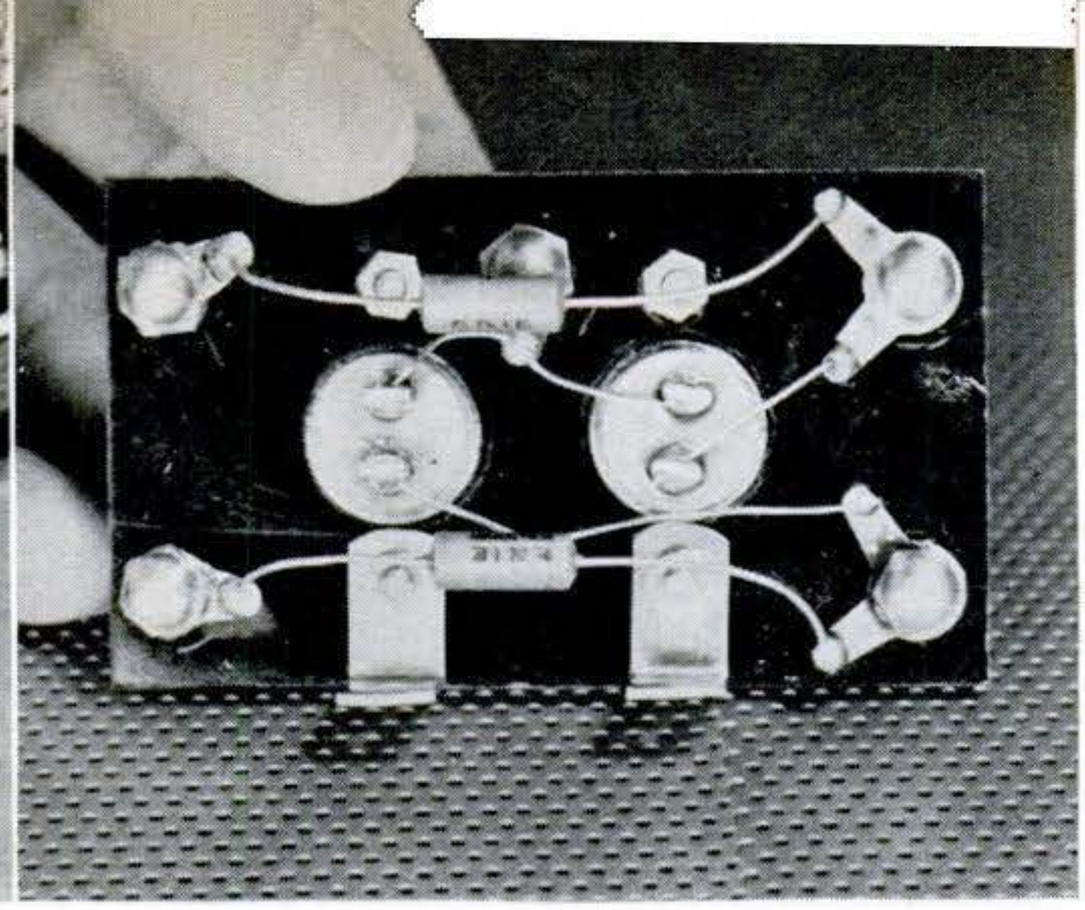
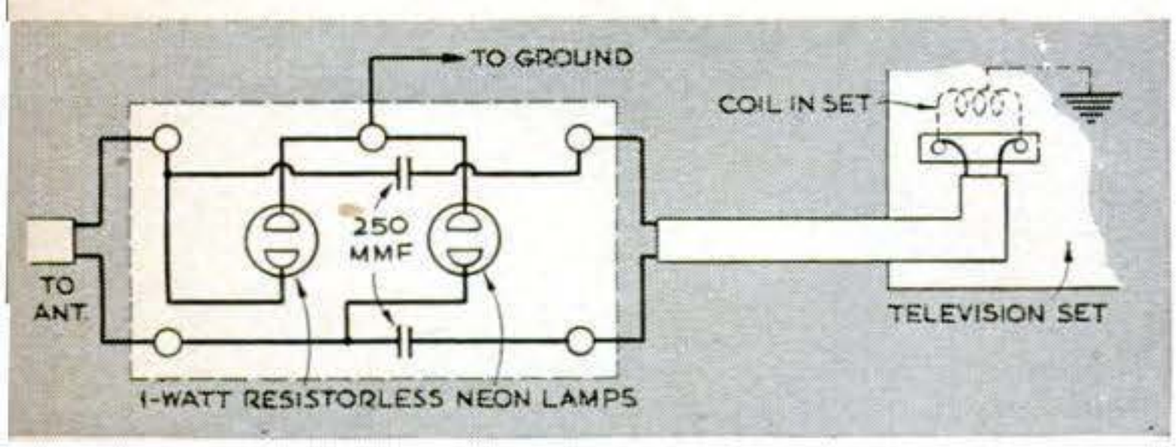
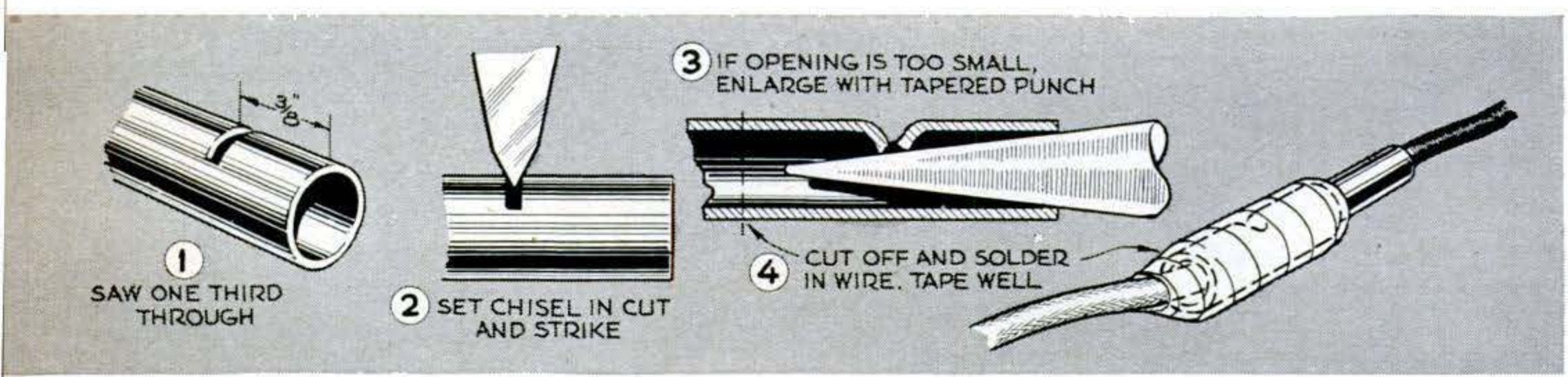




Lightning Arrester for TV

TELEVISION antennas sprouting from housetops have brought back some of the lightning hazard that existed in the early, long-aerial days of radio. A lightning arrester that will protect you from the worst dangers of the bolts can be made from a couple of neon bulbs and two ceramic condensers. Mount the parts on a small insulating strip as shown. Connect one terminal to a pipe or other good earth ground and pair the four remaining lugs to antenna and receiver. Should any large charge accumulate on the roof antenna, it will flash over to ground instead of going to the set.





Phone Jacks Made of Tubing

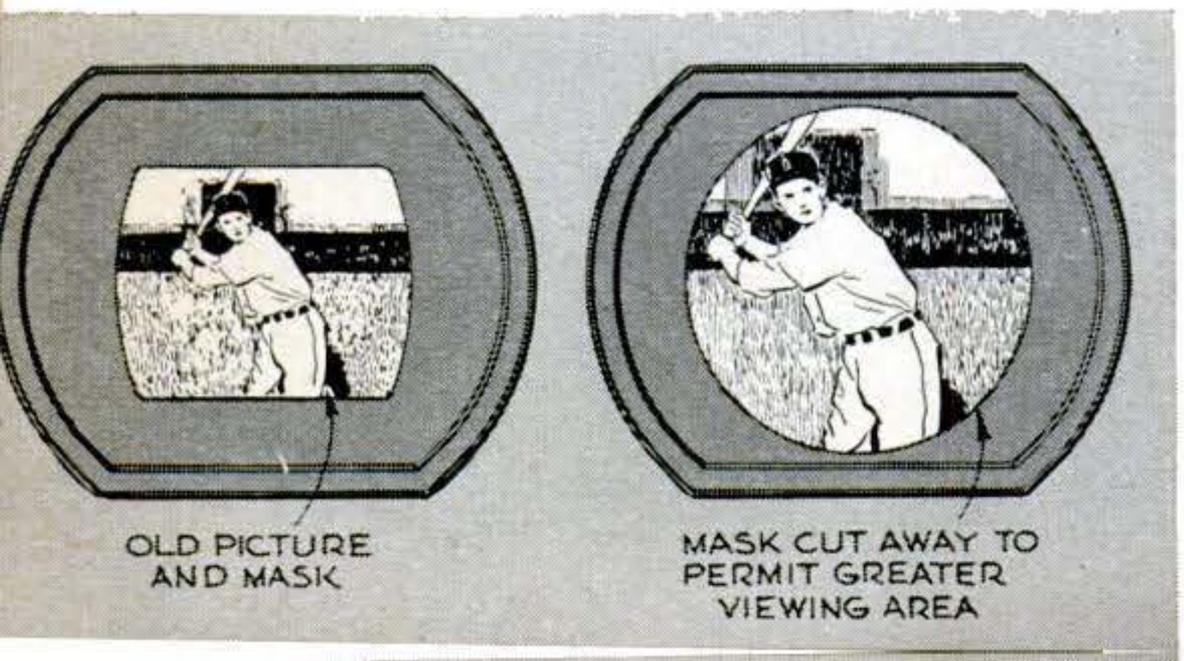
DETACHABLE jack connectors for phone tips and similar small plugs are handy for breadboard circuits, photoflash equipment, and model work. You can make good substitutes for ready-made jacks from hard brass tubing as shown above. Hacksaw a slot near one end and strike a chisel held in the cut. If the opening is too tight, enlarge it with a punch. Cut the tube off to a convenient length.

Enlarging Your TV Pictures

IF YOUR TV receiver is an early postwar model, it is probably adjusted to receive pictures in the standard 3-by-4 "aspect ratio." By sacrificing the corners of the rectangle, however, you can enlarge the central portion of the scene about 50 percent and utilize more of the tube face.

All you have to do is readjust the "fixed" width and height controls on the back of the chassis. Set the controls while a test pattern is on the screen. Keep the circular part of the pattern centered and as round as possible. Part of the wedge lines will spread off the tube face.

To take full advantage of the spread-out picture, make a new picture mask or cut away the corners of the old one. Be sure to replace the plastic or safety-glass shield.



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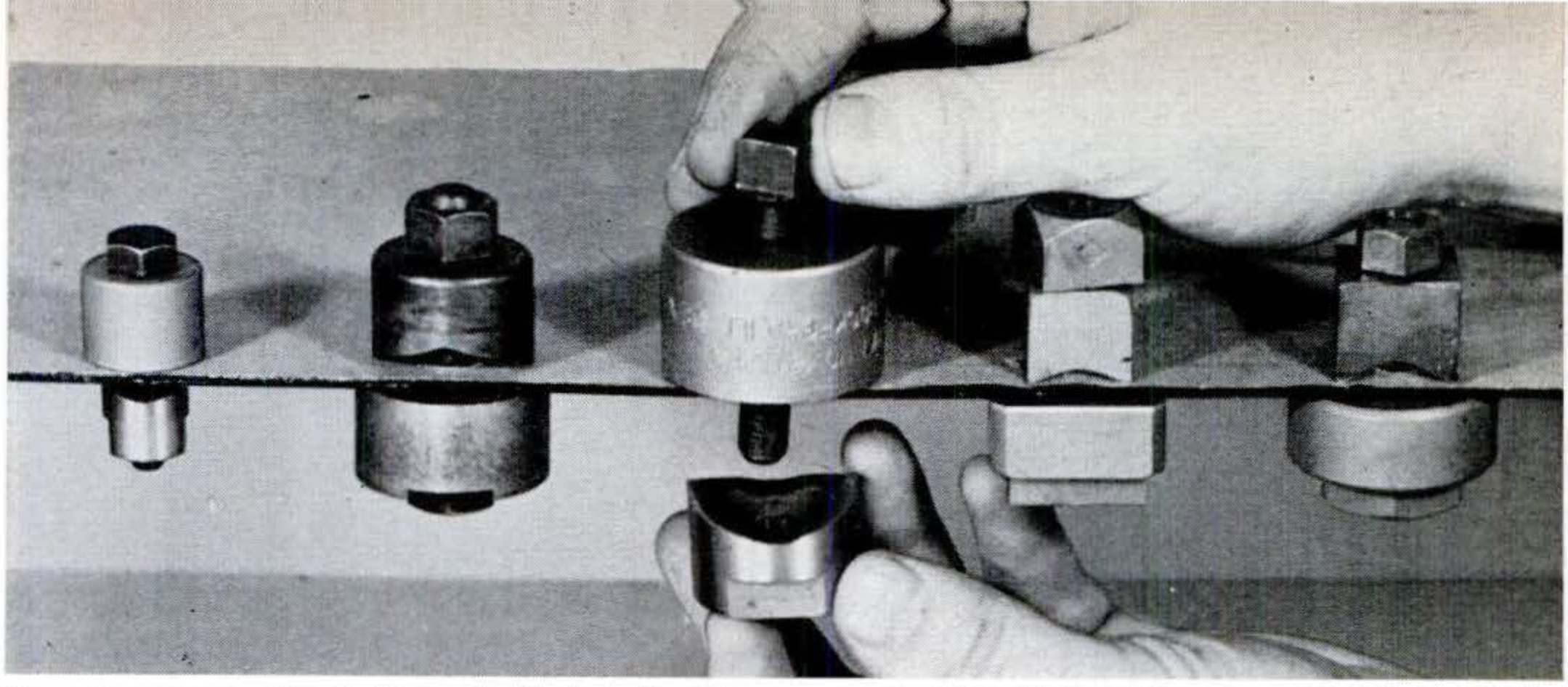


Drawing up on the bolt pulls the hardened cutter into the die, produces a cleanly cut hole.

Are You Using Chassis Punches?

They make big holes—round or rectangular—out of little ones.

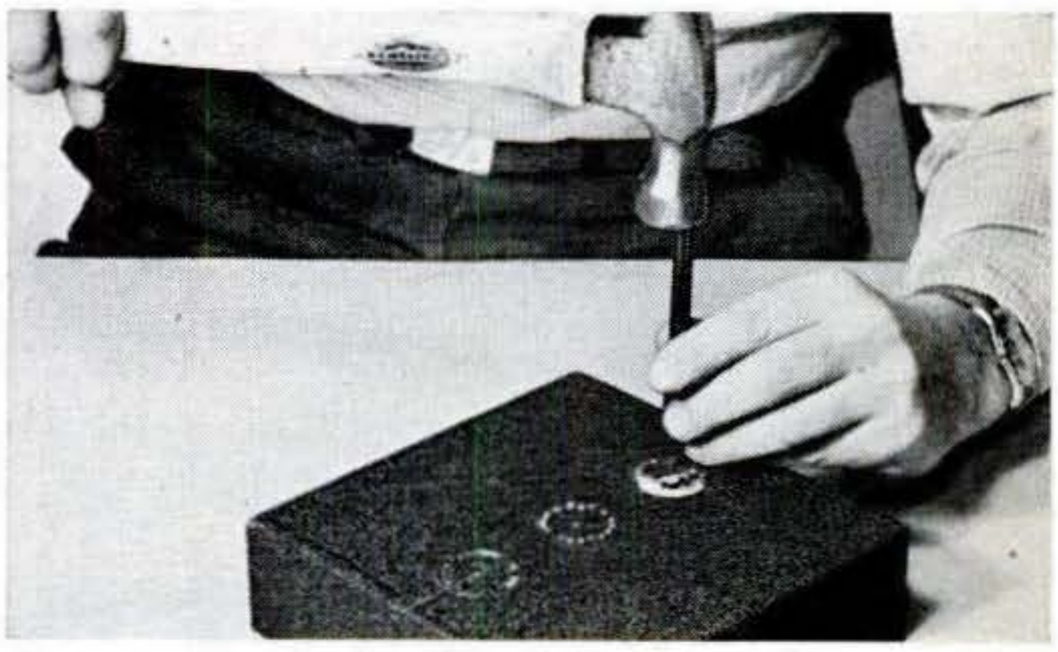
ONCE you graduate from the breadboard stage of radio building you sometimes run into metal-working problems that are tougher and more time-consuming than the wiring itself. The job of cutting holes in a chassis to take tube sockets, filter condensers, transformers, meters and the like can be a poser if your shop lacks an important yet simple piece of radio-making equipment.

Chassis punches have long been common in radio shops but many radio enthusiasts whose "workbench" is the kitchen table after the dishes are cleared away have tried to struggle along without them. Using other tools you can make big holes in metal in a variety of ways. You can drill a circle of small holes and chisel out the remaining metal, or you can chew it away with a jeweler's saw or file. Another method is to bore your largest twist-drill size and file out the rest. A hole cutter used in a drill press will also do a fair job. But as often as not the hole made by these methods will not be a smooth circle.

Chassis punches do the job better and in a fraction of the time. These tools consist of a cutting die, a socket, and a bolt that draws the die and socket together. The three steps involved in punching a perfect hole consist of drilling a single pilot hole (ranging from ¼″ to ½″, depending on the punch), assembling the die and socket on top and bottom of the opening, and drawing up on the bolt with a small wrench.

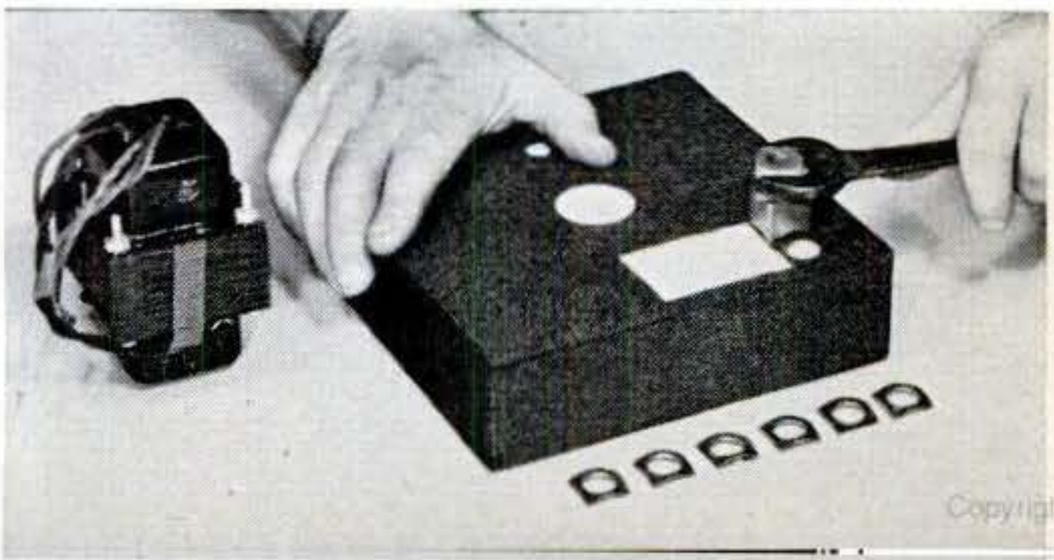
Aluminum and steel up to ⅛″ thick give way like cardboard to these cutters. They are available in about two dozen sizes ranging from ½″ to 3½″ round and ⅝″ to 1″ square. For radio work the 1 3/16″ round punch is a good all-around size.

The usefulness of the devices, however, isn't limited to radio. They can be valuable and timesaving in all sheet metal work, and there are many interesting and still unexplored possibilities in craft projects in brass and copper.—*R. Hertzberg, Queens, N.Y.*



One method of making a tube-socket opening is to drill a circle of small holes and chisel out the metal between. But punches do it better.

Large square or rectangular openings of any size can be sheared out with square cutters. Just overlap several bites as needed.



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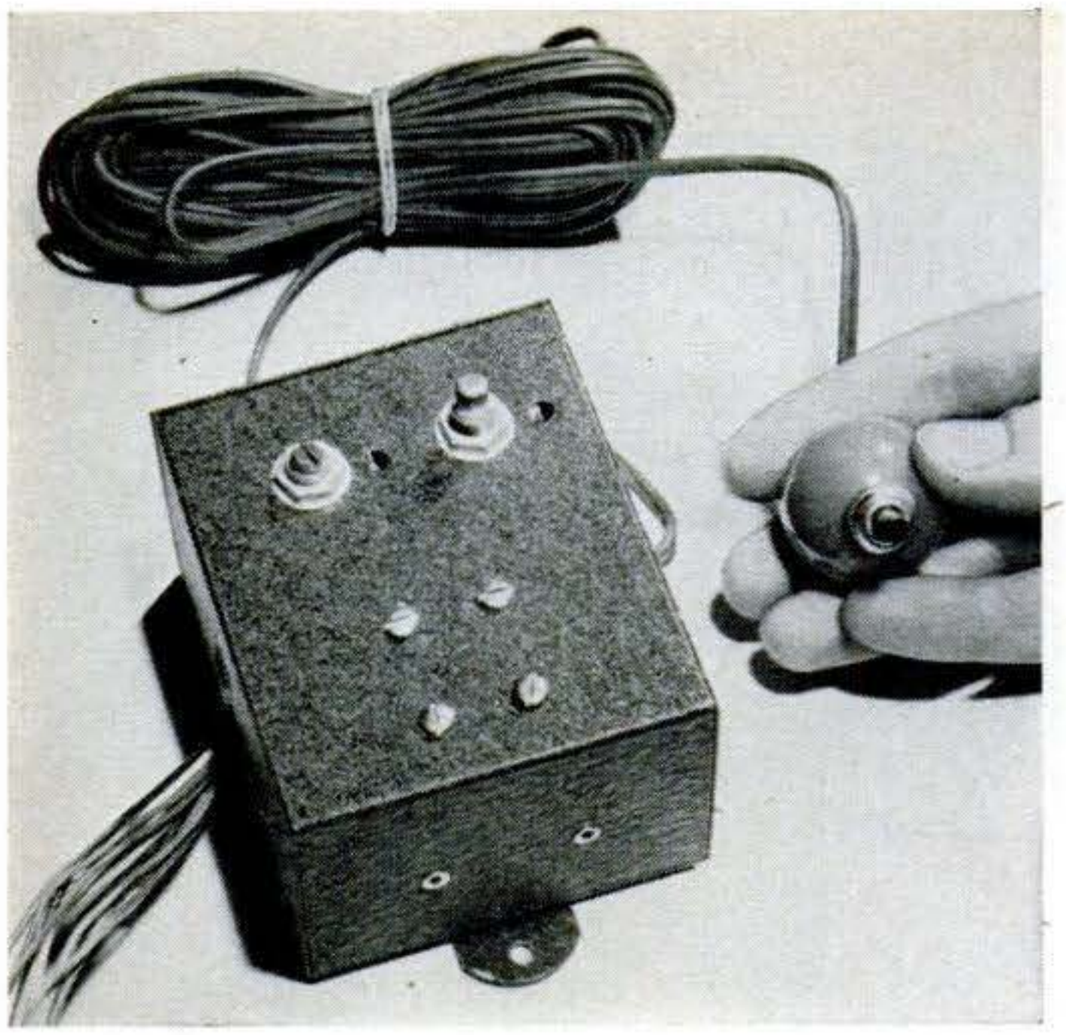
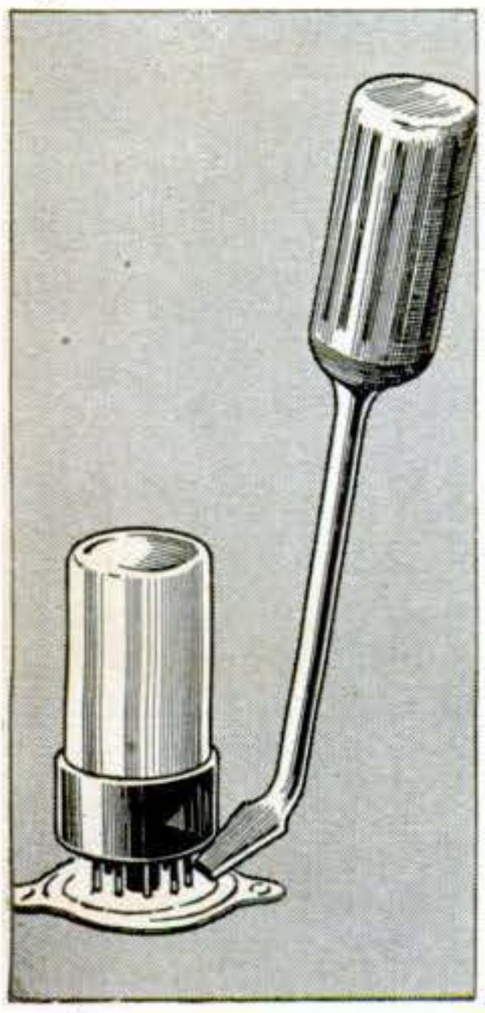


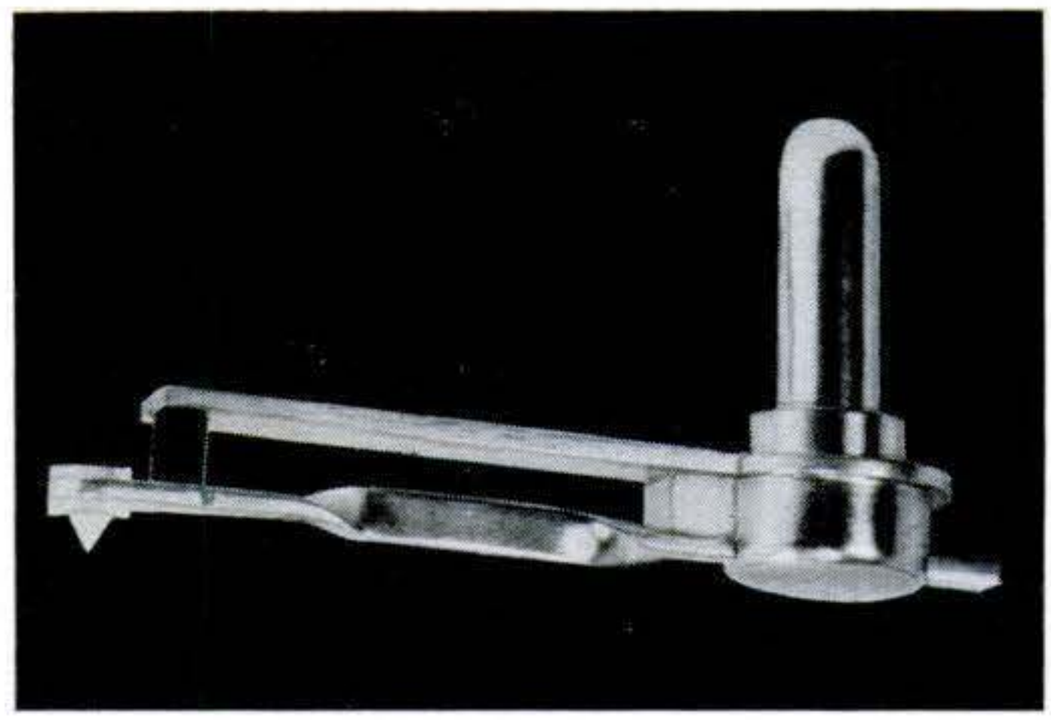
Enlarges TV Pix on Demand

ANY TV set can now have picture blow-ups at the touch of a switch. The electronic enlarger, above, can be attached to any receiver by 13 color-coded wires. It gives you push-button control of picture size; the remote switch at the end of a 25-foot wire instantly expands the central area of a picture or reduces the image to normal size. The metal box shown contains substitute width- and height-control potentiometers, which are switched in and out of the TV circuit by means of a relay. Selling for about $25 with installation instructions, the device is made by Federal Television Corp., N. Y.

Screwdriver Pulls Tight Tubes

A LONG-STEMMED screwdriver can be made into a tool for prying radio tubes out of their sockets. A bend of about 30° made in the stem allows the blade to be inserted under tube bases even in crowded quarters. Twisting the handle from side to side loosens the tube, and a backward pull lifts the tube out of the socket. In making the tool, soften the stem for bending by heating the metal till it turns red. Then let it cool slowly. Never use it when the set is on.—*Rufus P. Turner, Los Angeles.*





Double Twist Improves Stylus

THERE'S a new twist in phonograph needles. General Electric recently announced the modified stylus assembly, above, for use with their popular magnetic-type pickups. The lower horizontal bar in the assembly has been given a double twist that is said to provide extra damping and reduce "needle talk." It's now being furnished with new cartridges and is also available as a replacement for older ones.

The Height of Ingenuity

I once heard a truck driver cussing little cars. It seems that some big trucks and busses have a blind spot off the right front corner of the cab and a midget car fits into it very nicely. Since I want to keep my peewee car and I also want to keep on living, this is how I rigged up a warning signal to trucks:

I painted a rattlesnake and the words 'Don't Tread on Me" on a big square of yellow cloth and tied the cloth to the top of my car's radio antenna. Now truck and bus drivers see the flag, even if they can't see me or my car.—J. B. Ehrhardt, Madison, N. J.

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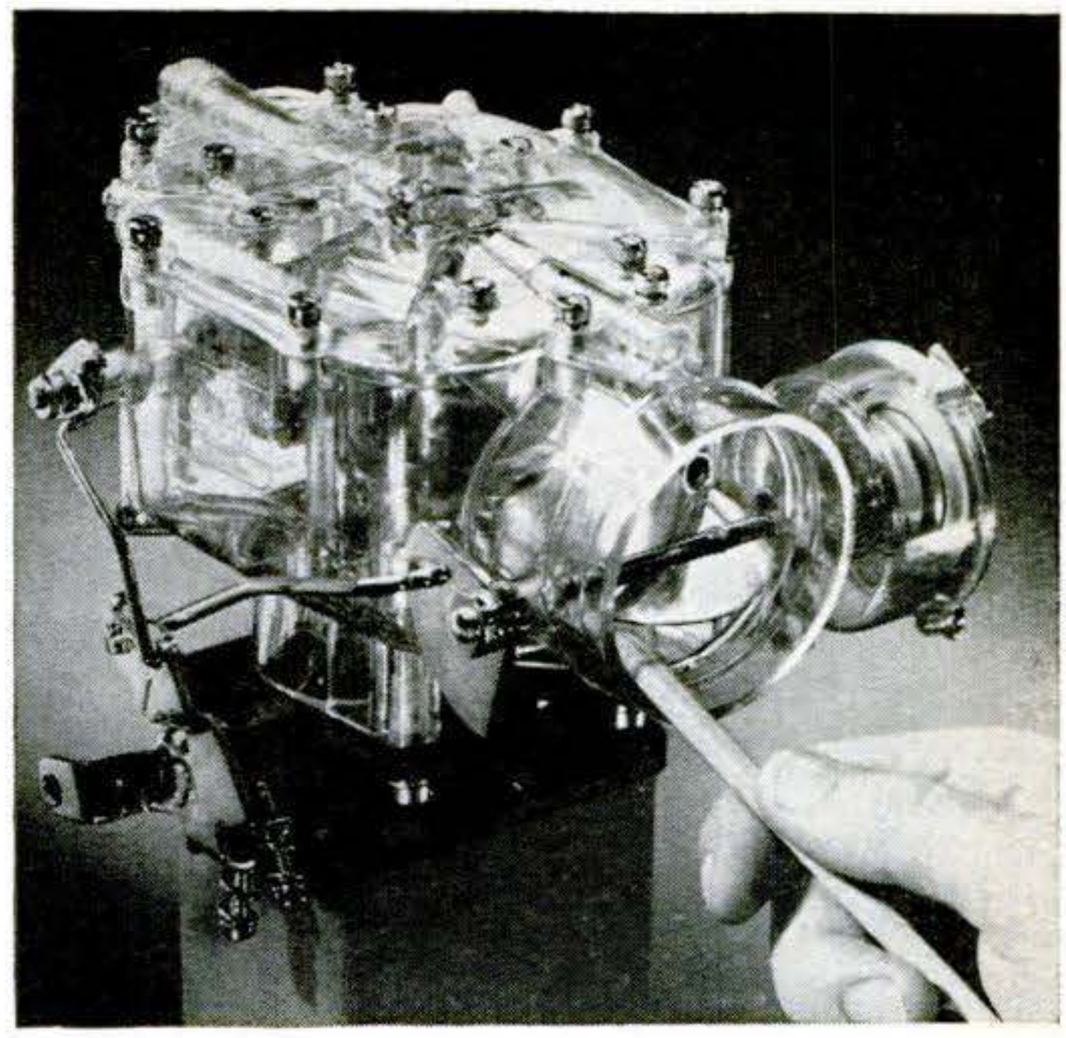
Abrasive Saw Cuts Pipe

EVEN the hardest cast-iron pipe can be cut quickly and easily with the saw above. Shown cutting a 24-inch gas main, the wheel, mounted on a Speedmatic Saw®, is abrasive throughout and is said to perform better than types abrasive only on the edge. Made by Porter-Cable, Syracuse, N. Y., the saw cuts tile, brick, and sheet steel.

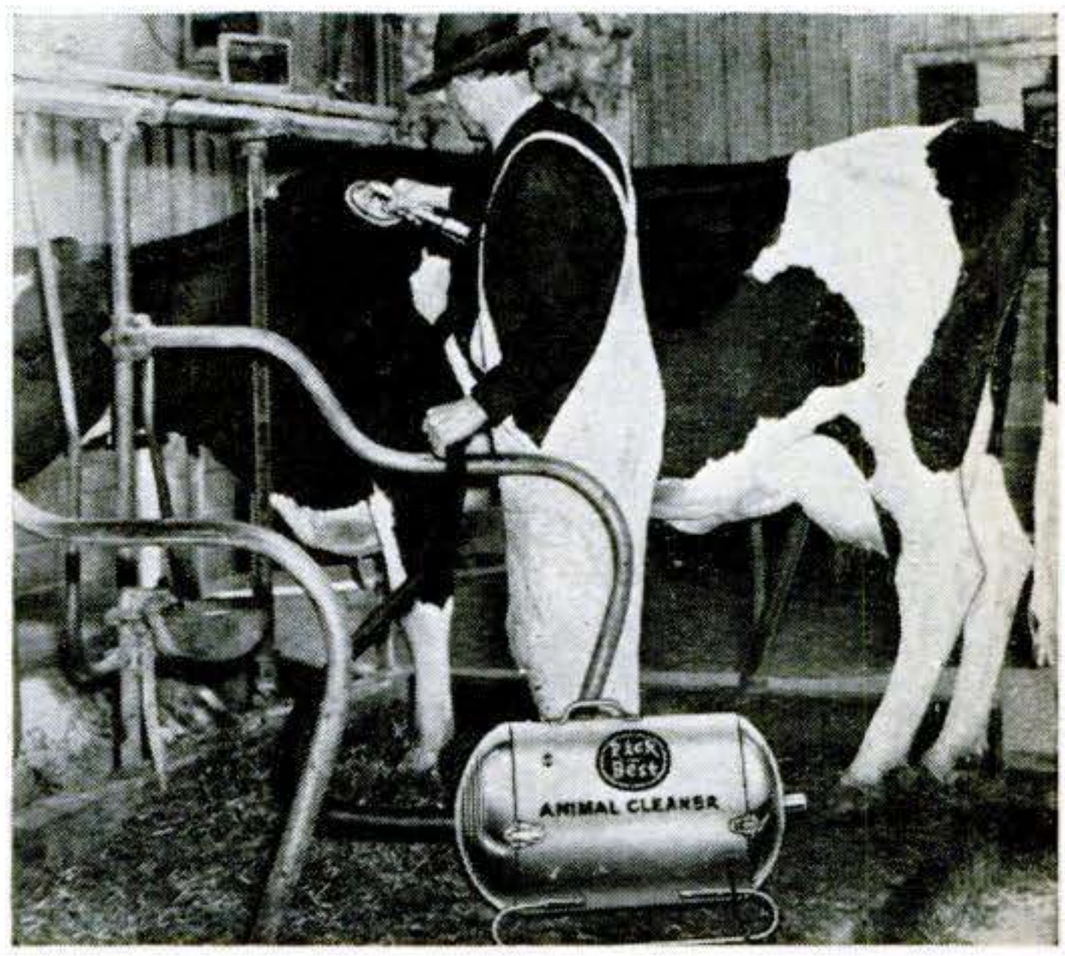
Pad Pads Housemaid's Knee

MADE of black vulcanized rubber, these pads are designed to protect the knees while gardening, painting, or performing household chores. A waffle tread prevents the pads from slipping and a sponge rubber lining provides a cushion for the knees. Adjustable straps hold the pads securely. They are made by the Judsen Rubber Works, of Chicago.



Carburetor Shows Its Insides

PLASTIC replicas of automobile carburetors are being produced by injecting clear Tenite® into the same dies used for making the actual metal carburetors. The durable, lightweight models are excellent for instructional purposes and sales promotion since you can see the various operating positions of controls otherwise hidden. Ontario Plastics, Inc., Rochester, N. Y., is using the new process.



Vacuum Brush Cleans Cattle

THIS barnyard vacuum cleaner will keep farmers as contented as their cows. Designed to speed the job of cleaning cattle, it has a brush head that loosens dust or dirt on the animals' hides so it can be drawn into the cleaner. The Power-Vac®, made by the Pick Mfg. Co., West Bend, Wis., is said to promote the health of cattle by cutting down dirt in the air.

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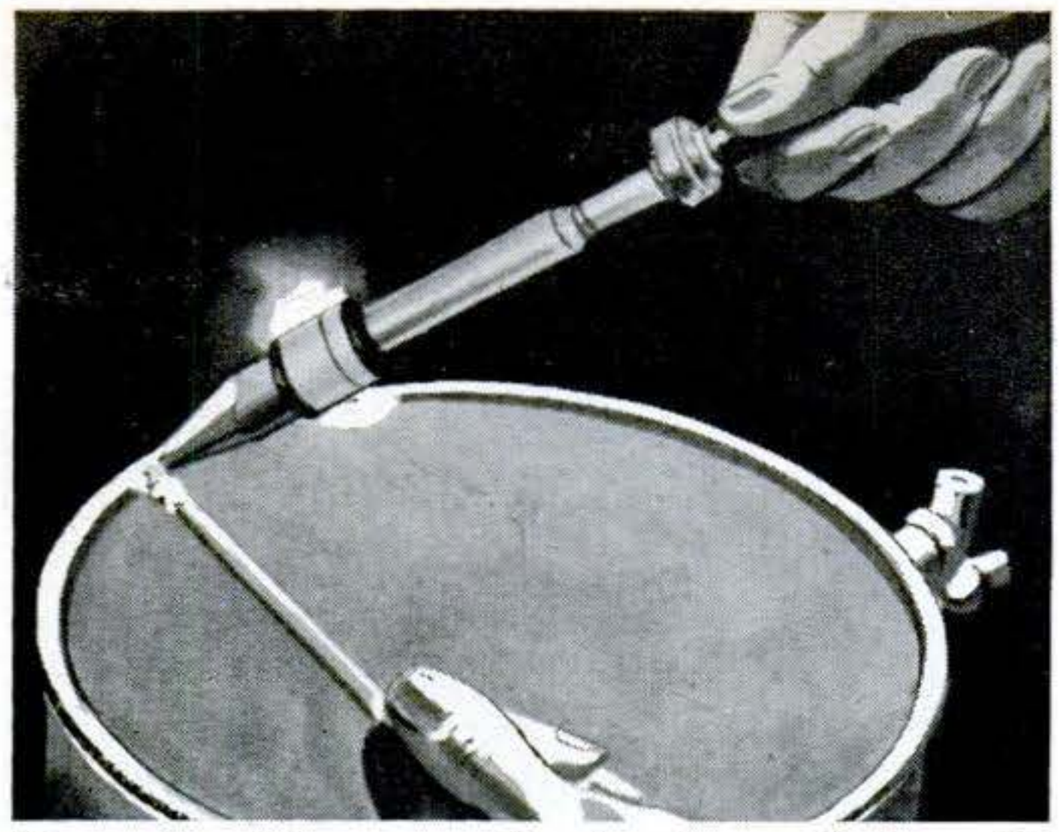
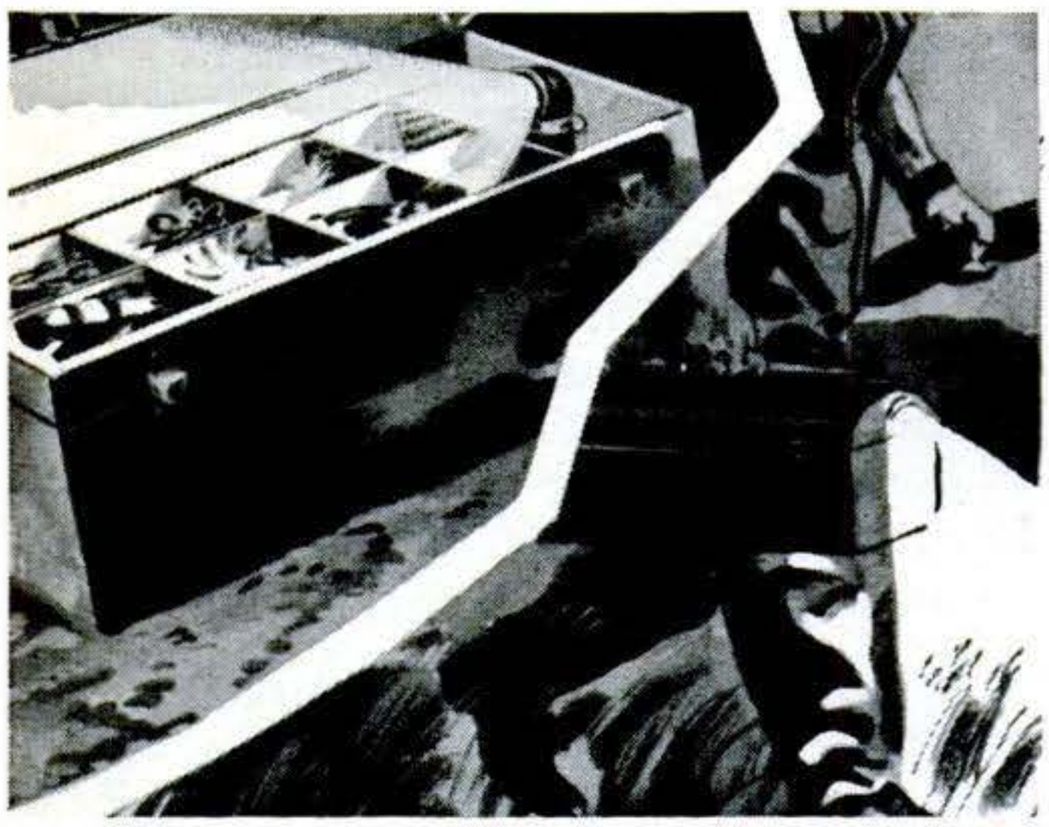
I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

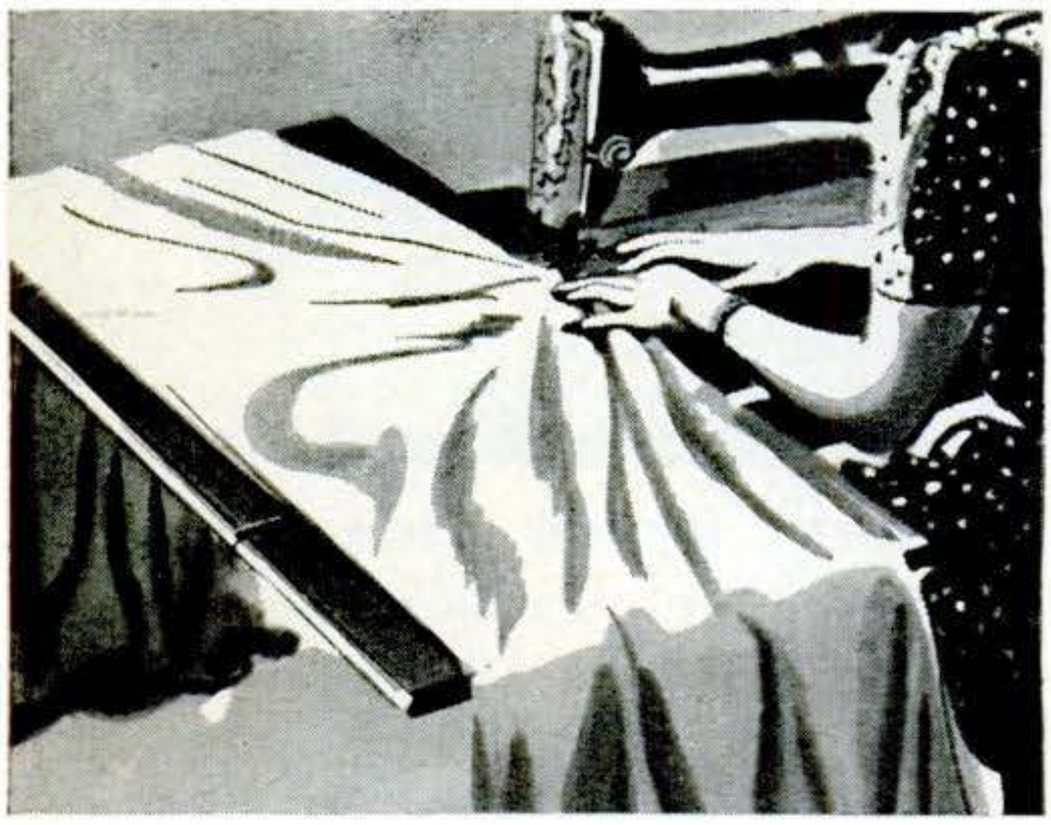


Ceramic collars on soldering irons that would change color with heat to tell you when the iron was hot enough to use, and also to let you know when the iron was overheating.—*John Smith, New York City.*

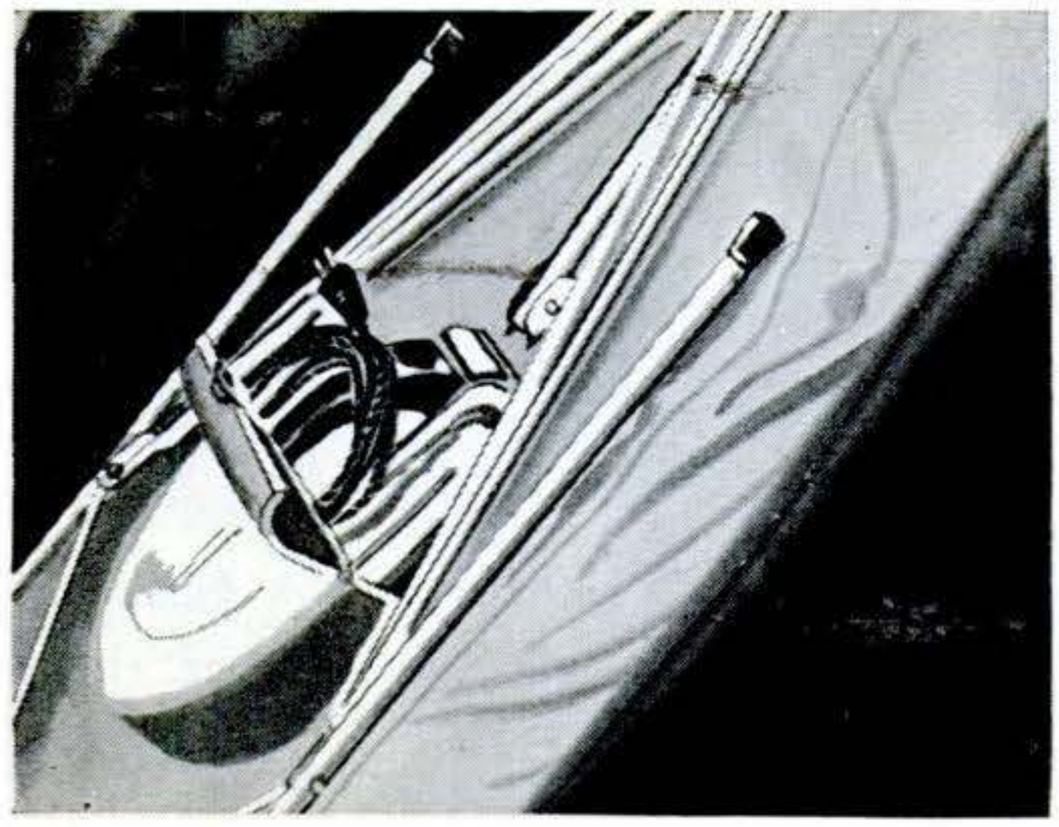


Fishing-tackle box with a built-in, double-ended flashlight. For night fishing, one lamp would light the trail ahead of you. The other would light the interior of the box—*Mike Nic, Muskegon Heights, Mich.*

Valves to fit the connections between sections of garden hose. Then you could see to adjust sprinklers even when they weren't visible from the faucet at the house.—*Jim Herren, Great Bend, Kan.*



Clip-on extensions for the cutting table of a sewing machine. Such extensions could be used when sewing heavy material to keep it from slipping to the floor.—*Mrs. Charles Mollenshott, Ebenezer, N. Y.*



Fireproof compartments on ironing boards. It's always a problem finding a spot to park an iron until it cools off. You could store it away immediately in such a compartment.—*Miss E. Marin, Wellsburg, W. Va.*

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Update That Old Upright

Cutting down the box makes a bulky piano as attractive as a spinet in a modern living room.

By Ralph Treves

OLD upright pianos often have better tones—and cost much less—than small spinet-style ones. If you're handy with tools, you can reduce the bulk of an old piano and make it look as attractive in your living room as a new model. And you don't have to tamper with the action of the piano.

Here's how:

Start by removing the front and top. Press down a key at the very end of the keyboard. Watch the arc that the hammer passes through. Use chalk to mark this arc on the inside of the side panel. You'll find there is considerable free space between the arc and the front and top of the side panel.

Use a square and chalk to mark the outline of this free space on the outside of the piano ends. Be sure the vertical and horizontal lines on the two ends duplicate each other. The lines on the ends of your ➧

1 **Thick lid is replaced** by plywood mitered to fit plywood sides. Join with glue. Strips screwed to side panels were cut from old lid.

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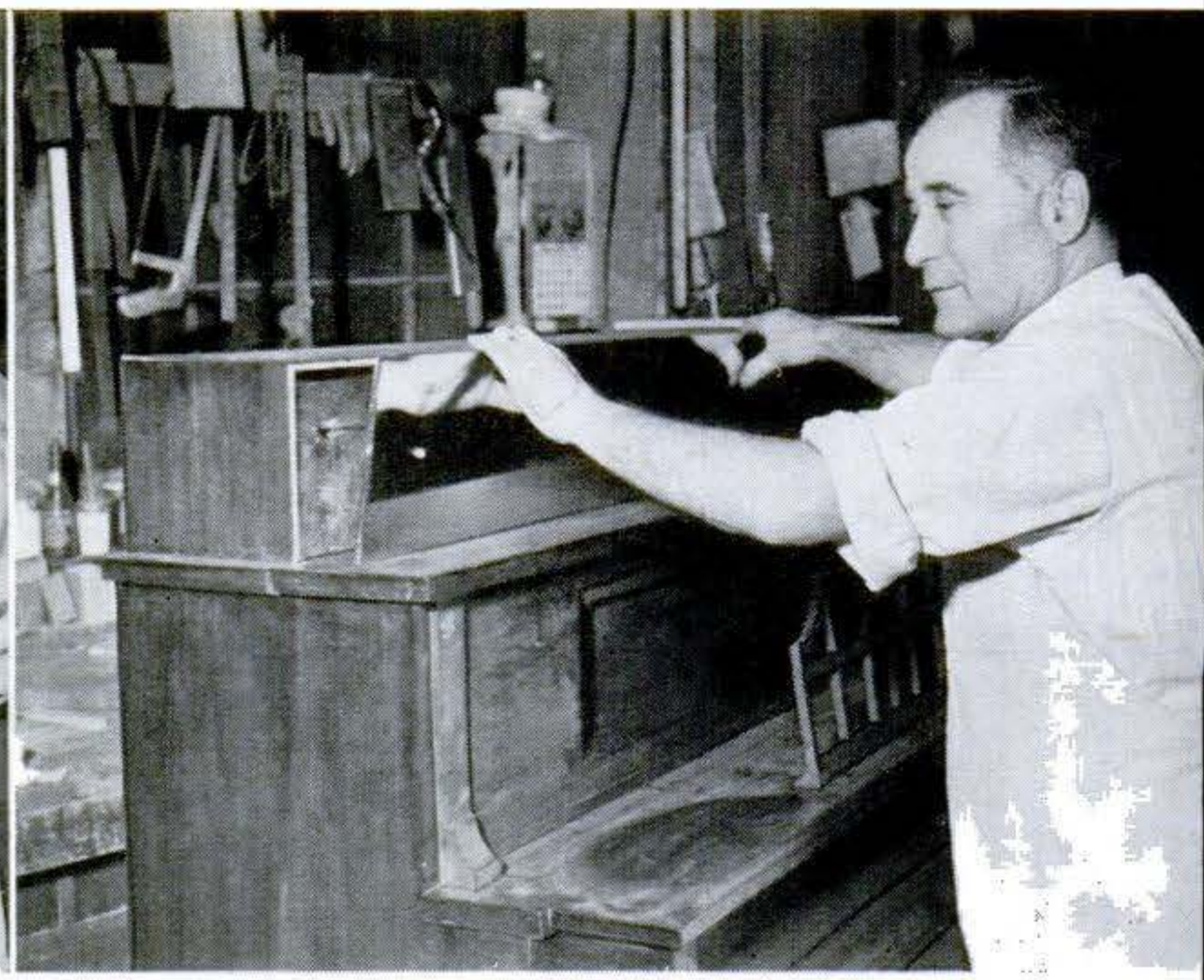
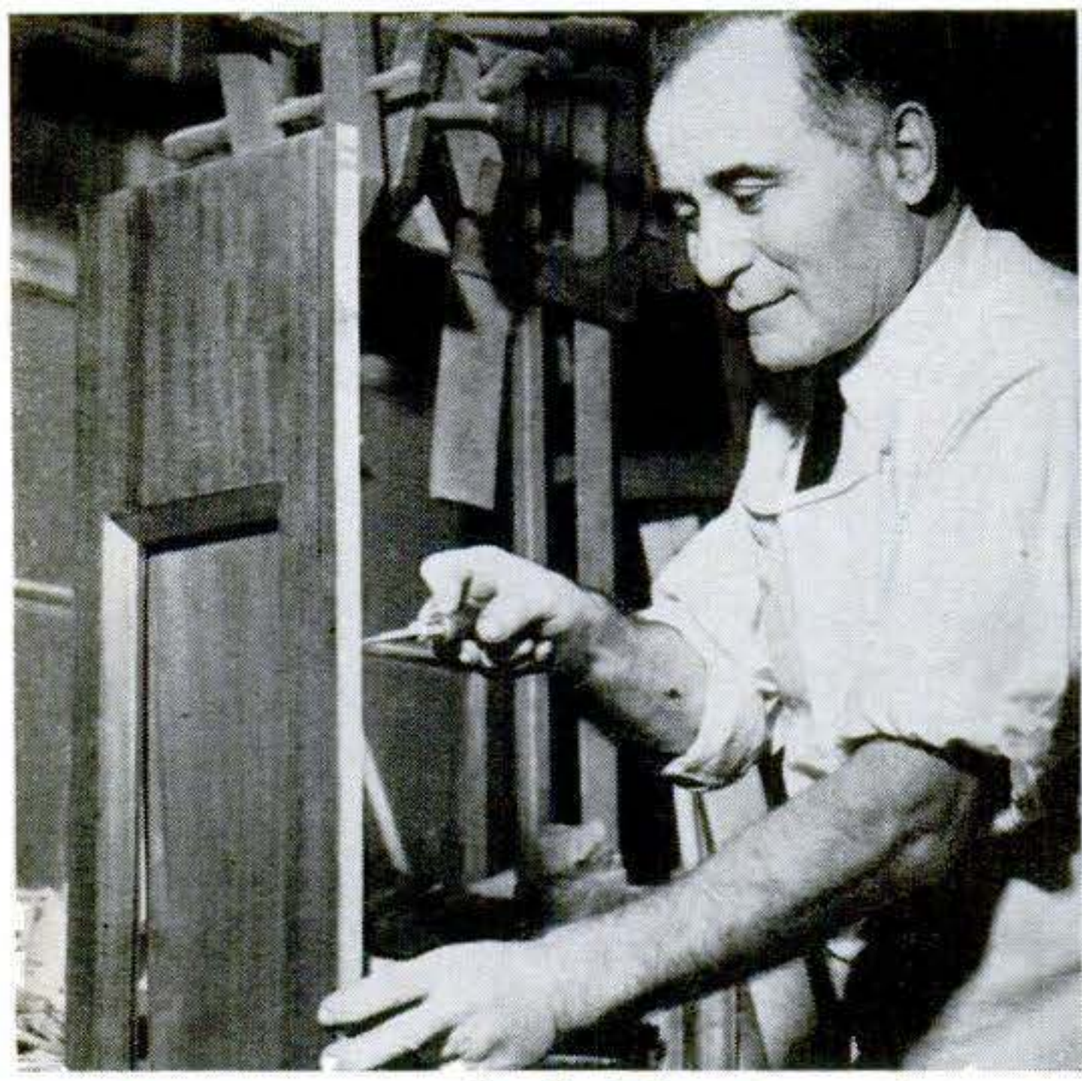
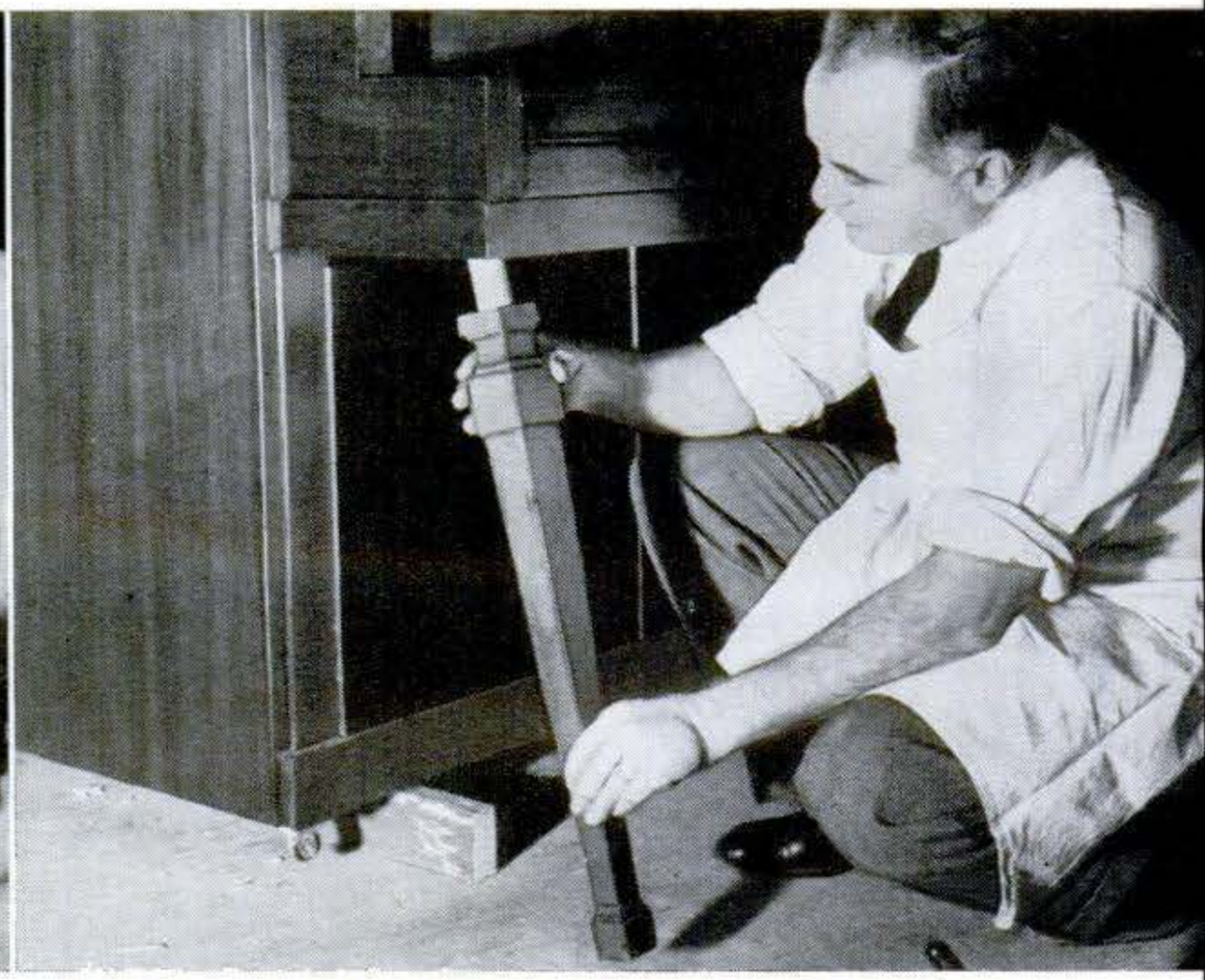
2 Old lid, cut down to fit, is placed on its new lower level. Steel pins at each end of the frame fit into holes drilled in the lid.



3 Mirror is set in place. Plywood backing is screwed to blocks at each end. Wood screws, covered by glass buttons, hold mirror.



4 Oblong cutout, backed by plywood, gives narrowed front door paneled effect. Inside edges are trimmed with mitered molding.



5 Heavy toe has been cut away and new leg is being fitted. For support, casters are put under front of case as well as under new legs.

piano now should look about like those in the drawing on the opposite page.

If the top of the action reaches to the top of your piano, you won't be able to make cut A. You can make cut C as shown, or you can carry it all the way to the back of the piano as I did and cover up the exposed sides with ¼″ or 5/16″ plywood. Cut D goes all the way to the music-rack level. Use mitered joints where top and sides meet. Join them with glue and brads. Cut a piece from the old top to make an overhang at the bottom of the plywood sides, as in photo No. 1.

Saw a piece from the original top to make a cover for the open space at the new level. Photo No. 2 shows this piece being installed. This part must be removable for piano tuning. Drill a vertical hole at each end of the frame and matching holes in the cover. Insert steel pins in the vertical holes in the frame. When the cover is in place, the pins hold it solidly.

Now cut a piece of plywood to back up the mirror that faces the top level of the case. This plywood front is screwed to blocks that are screwed to the sidepieces.

The old front panel now will no longer

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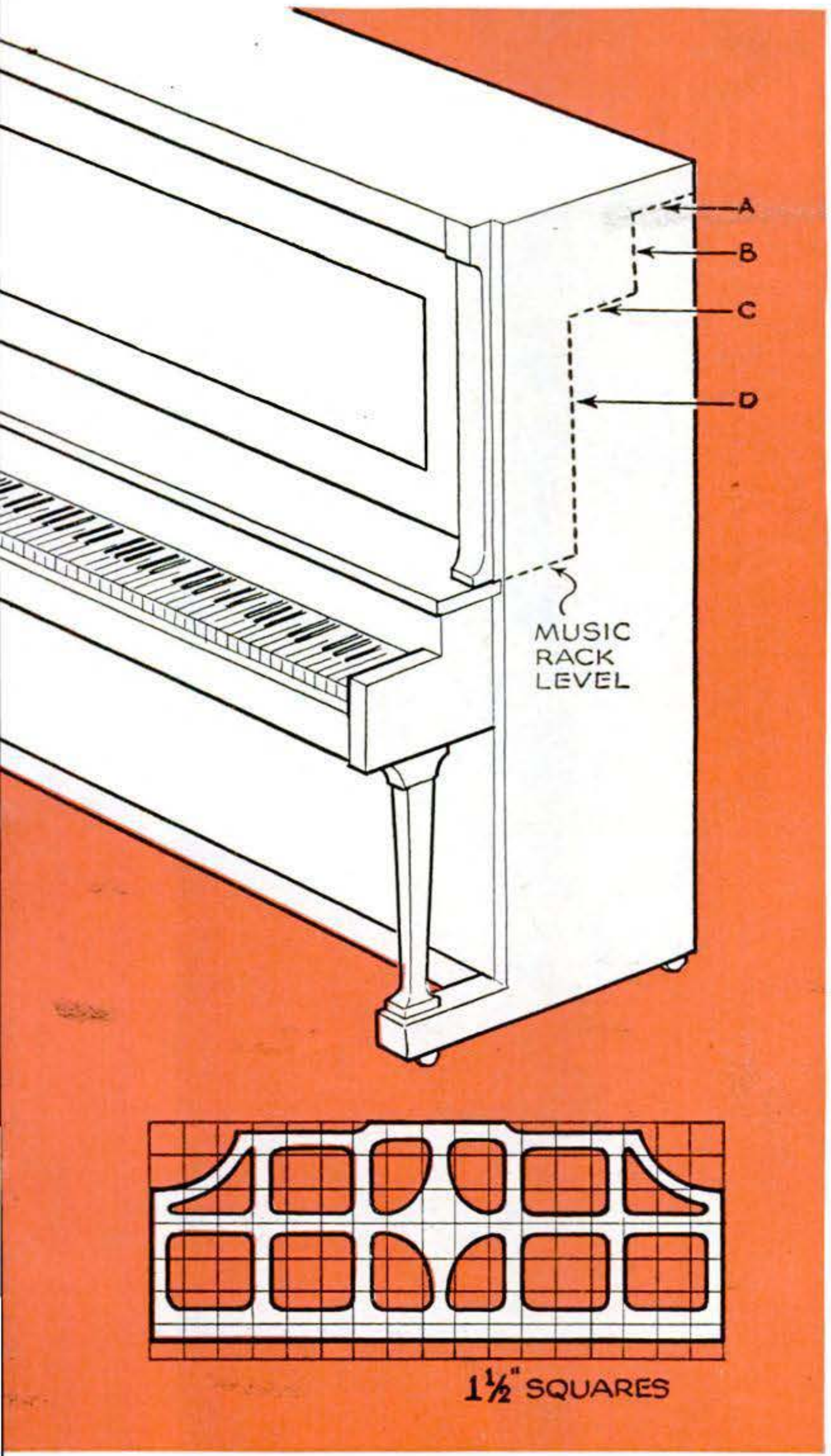
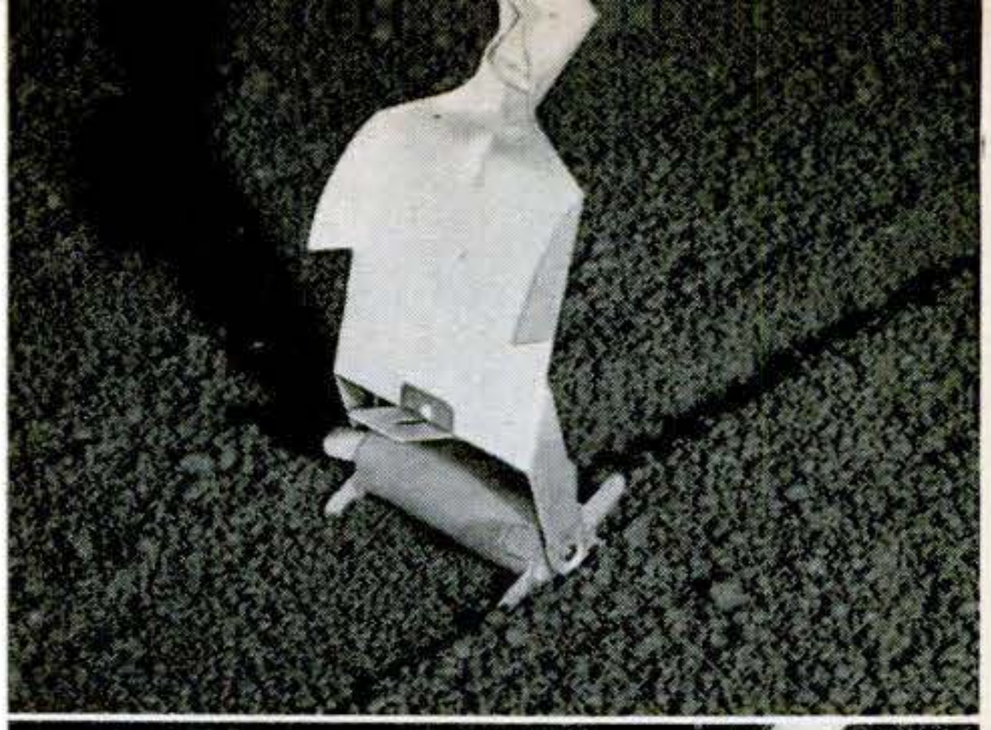


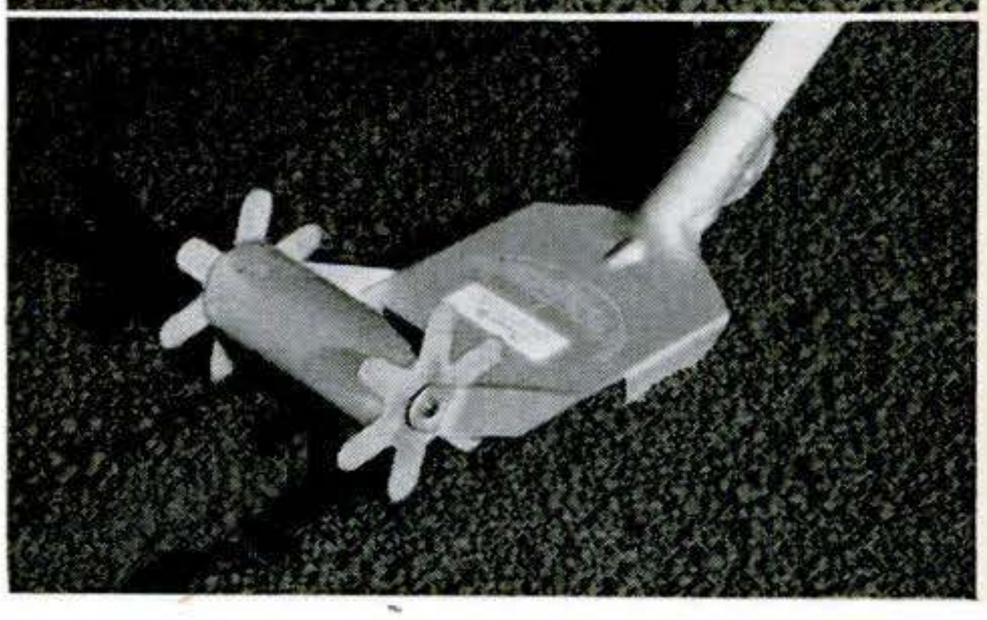
Where to make saw cuts in end panels is shown at top. Jigsawed music holder is mounted on 1" by 1" base, screwed to the case.

fit its original space. Cut it down to fit. To get an ornamental effect, saw an oblong section out of the narrowed front. Back up this opening with plywood (photo No. 4) and trim the edges of the opening with molding.

Next replace the shortened columns at each end of the front panel. Attach them with wood screws.

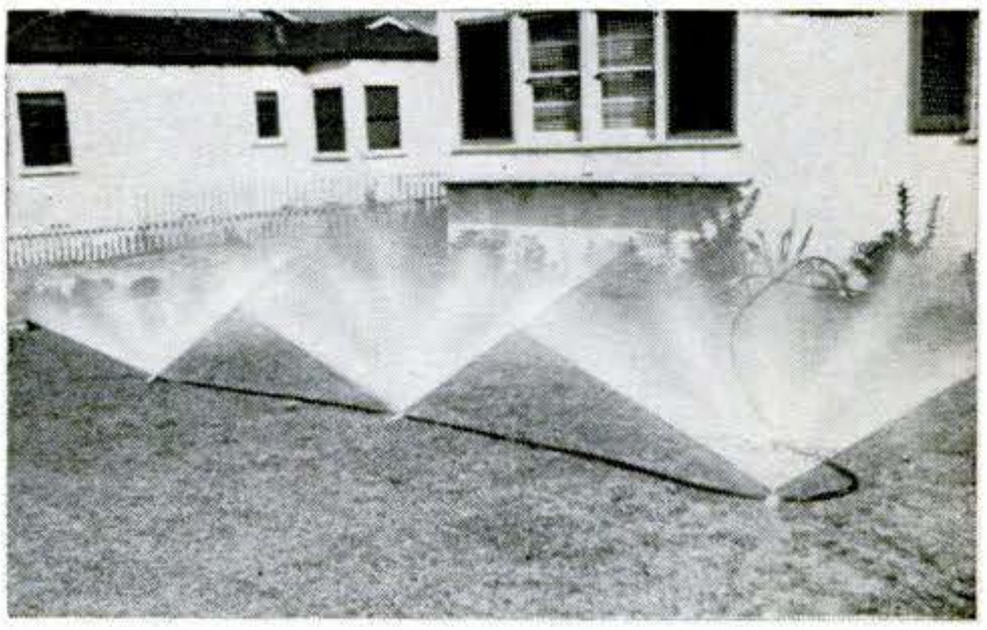
Replacement of the heavy wooden toes with new legs is another refinement that adds to the modernization. If you do this (photo No. 5), you'll want to add casters at each front corner of the piano case. END





Tool Digs, Covers Furrows

PLANTING seeds is easier with this $1.69 tool that cuts a furrow and then fills it after you've sown the seeds. Top photo shows a furrow being covered; bottom photo shows one being dug. To vary the depth of a furrow, you adjust the cutting blade with a wing nut. After the seeds are sown, you turn the tool over so that the roller then rests across the furrow. As you pull the tool the roller fills the furrow. The manufacturer is the Tommie Company, of Minneapolis.



Portable Sprinkler System

THIS sprinkler unit consists of 18 feet of hose plus three aluminum spray heads spaced 8 feet apart. Hook it up to a hose and you can cover 1,000 sq. ft. of lawn with spray. The distributor, Troup Engineering Co., Long Beach, Calif., prices it at about $10. Extra individual units for watering large lawns are available. Each spray head is separately adjustable from a full-sized spray to a few drops.

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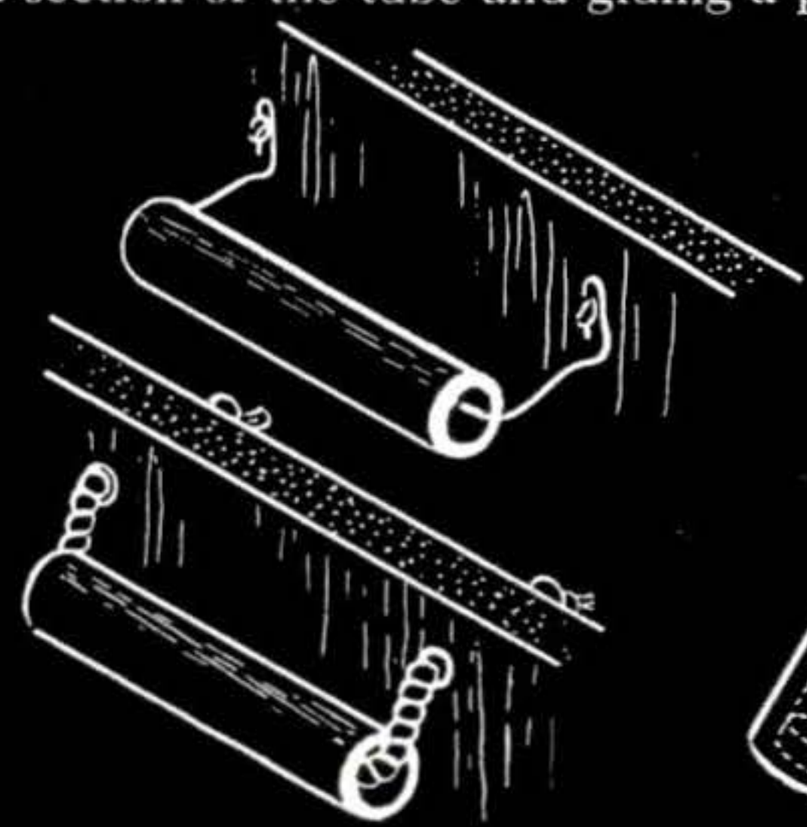
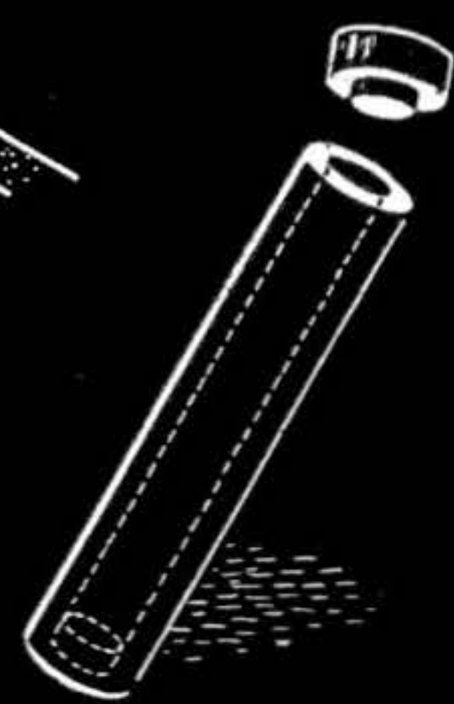
Eight Uses for Old Package Handles

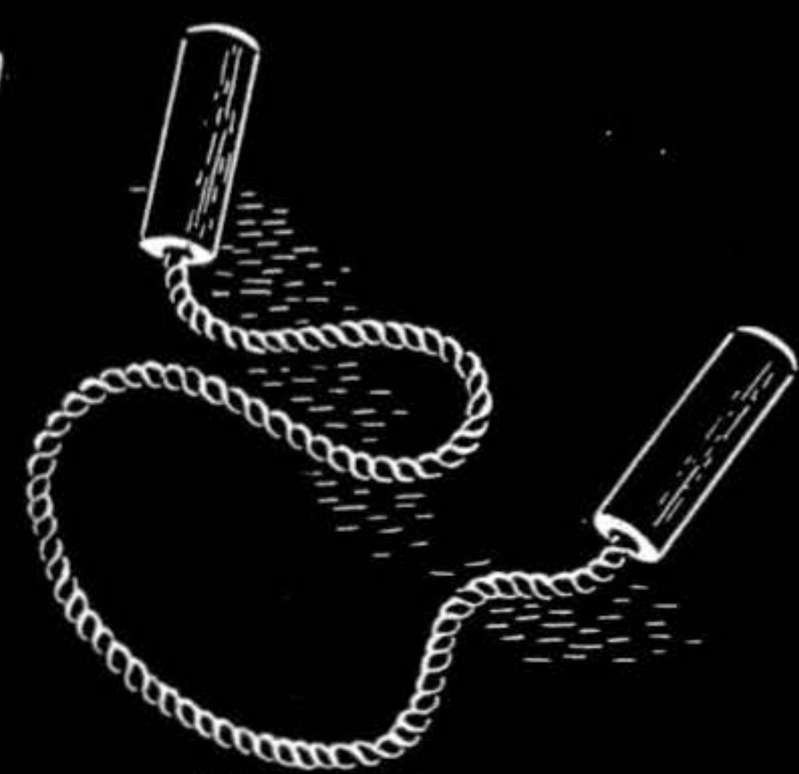
If you've accumulated a number of old bundle grips, here are a few ways you can put them to use. The container for needles or pins is made by cutting off a section of the tube and gluing a piece of dowel in it to form a cap. The skipping rope is made by gluing the rope in the handles. Another use is as handles for small tools such as a file, ice pick, or a knife blade.



DRAWER PULLS

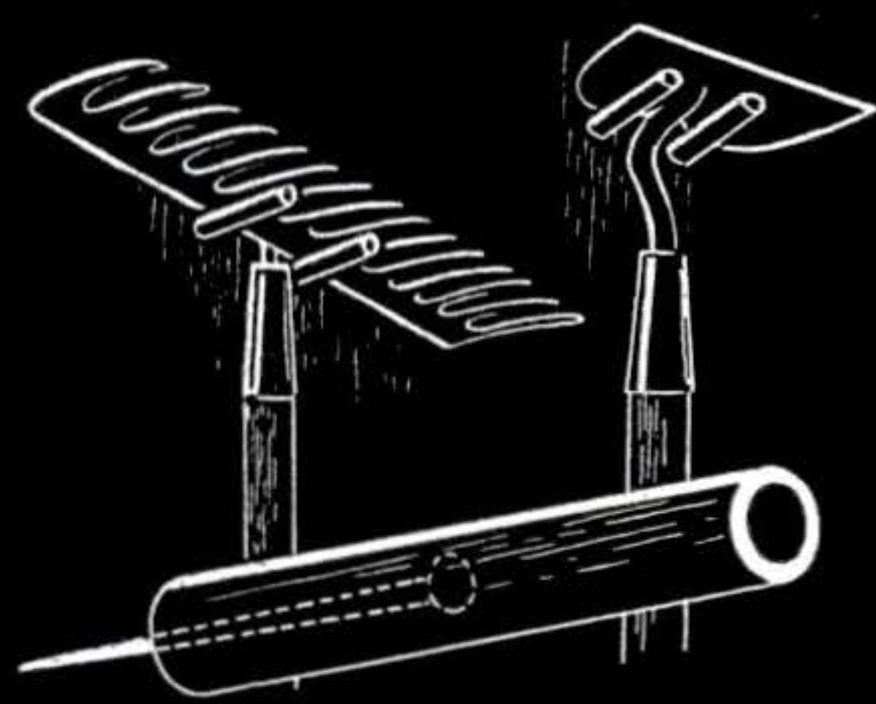


CONTAINER



SKIPPING ROPE

HOT PAD



TOOL HANGERS

KEY HOLDER

YARN HOLDER

TIE RACK

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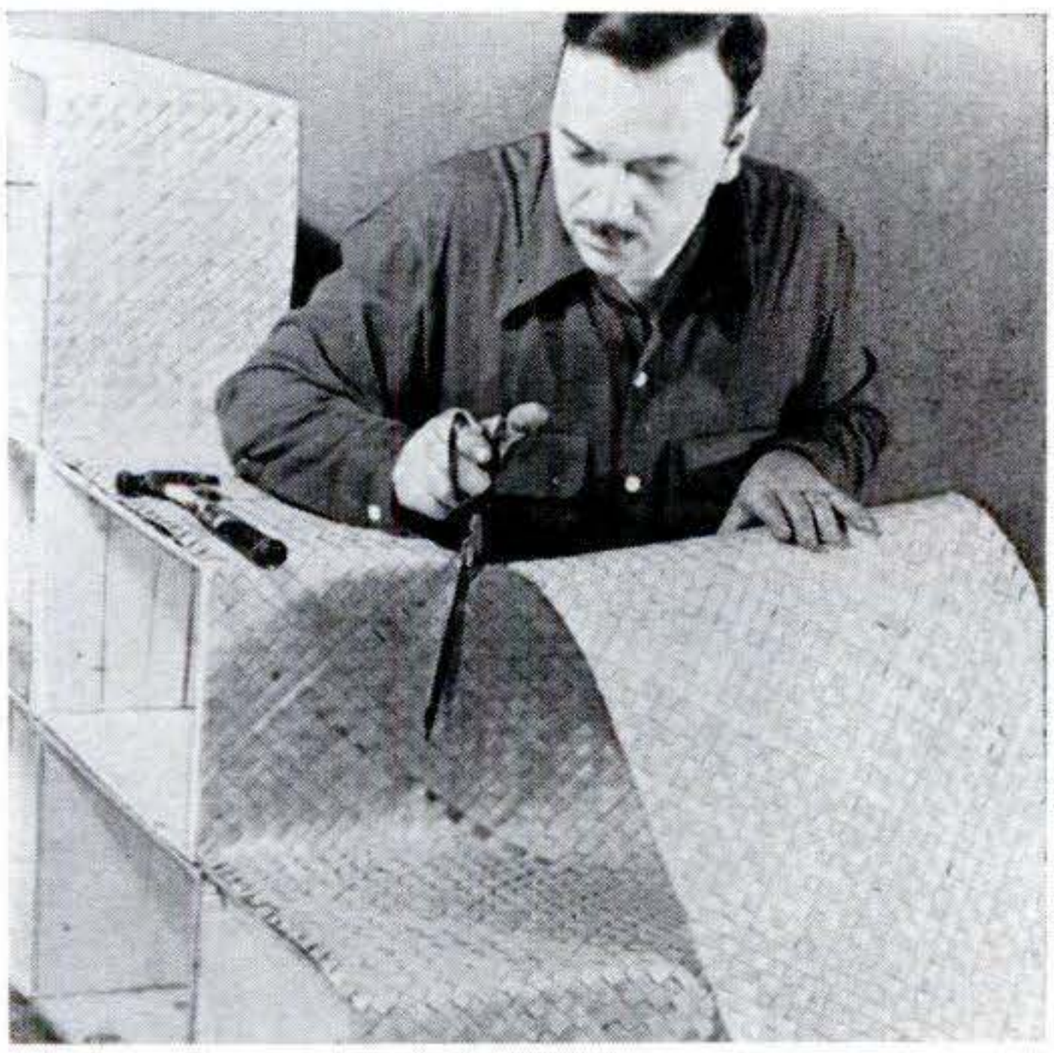
Bamboo + Boxes = Bookcases

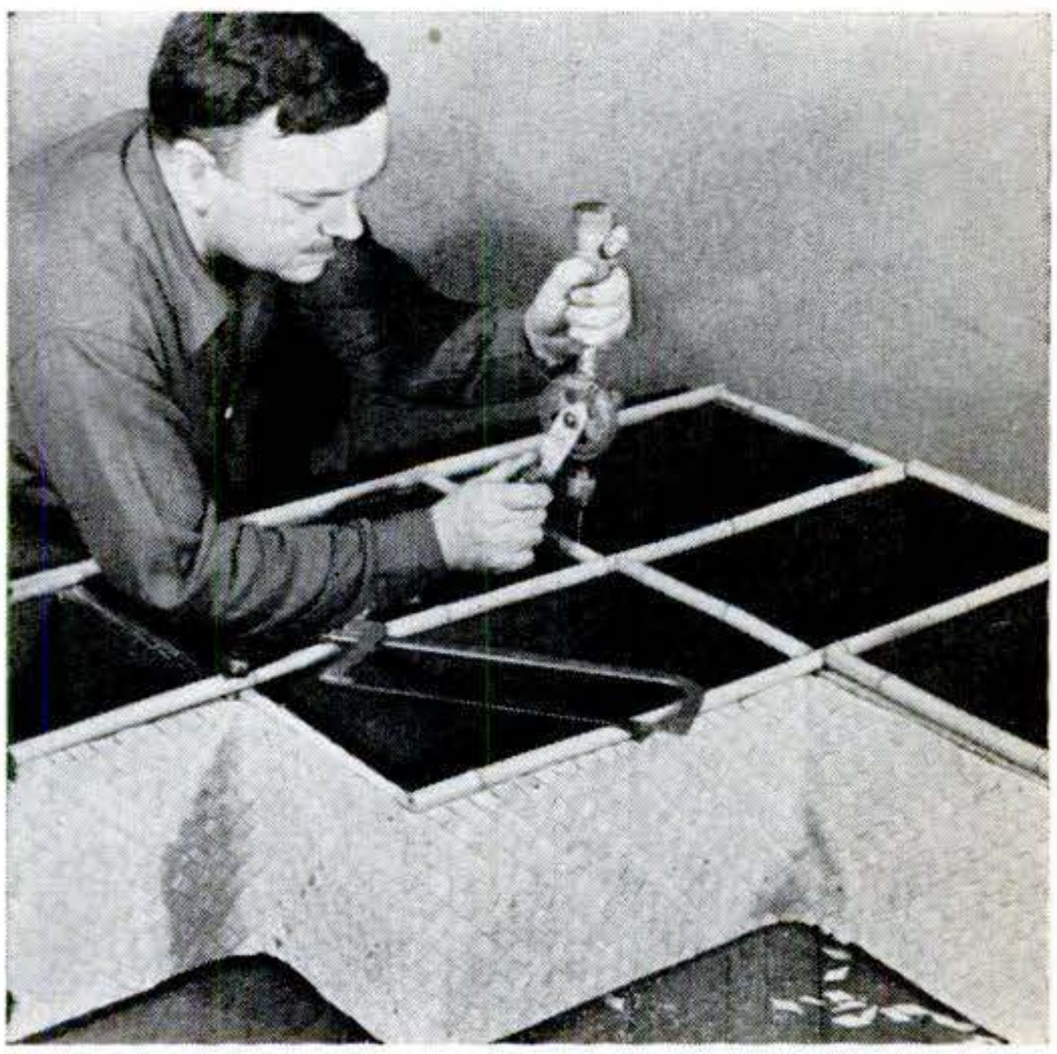
SIX wooden boxes, an equal number of 6-foot bamboo poles, and a roll of tropical matting provide the materials for this bookcase. The tools you need are a hammer, scissors, saw, and drill. Use a fine-toothed saw to cut the bamboo. A hacksaw will do. Drill holes through the bamboo for the nails. If you don't drill first, you may split the bamboo.—*George Daniels, Glenville, Conn.*

Stack the boxes like this and nail them together. Four nails along each joint will do. The high end of the bookcase may be at left or right.

Try on the tropical matting to be sure that any necessary splices will come at corners. The bamboo trim will conceal them there.



Tack the matting along the front edge and then trim it. Any slight irregularity in box sizes is taken care of by this method of cutting.



Drill the bamboo and fasten it on with finishing nails. Horizontal trim is continuous from end to end. Vertical trim is cut to fit.

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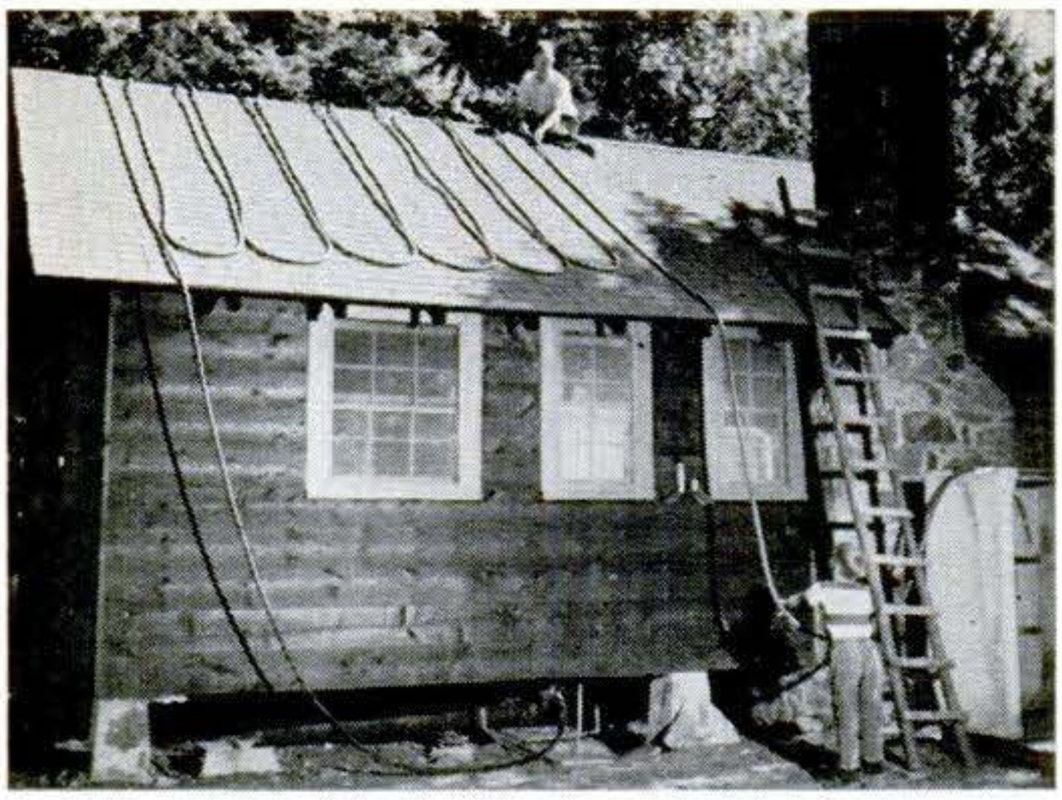

Hose and Sun Heat Water

HERE'S an inexpensive, practical way to provide a summer cabin with hot water. The owner of the cabin pictured here, Charles B. England, a U. S. Rubber Co. employee in Passaic, N. J., strung 150′ of black-colored garden hose over the roof. One end of the hose is attached to a faucet. The other end leads to a shower stall.

On sunny days from May through September, the cabin has enough hot water for three showers before the supply runs out. It takes about 20 minutes for more to heat.

Boxed Charcoal Saves Hands

IT'S easier to handle charcoal on picnics or at your back-yard grill if you package it in cardboard containers. Pack each box full and seal the lid with tape so the black dust can't sift out. To start a fire, place a package on the kindling. After that, simply add more containers as needed. The burning cardboard helps ignite the charcoal.—*Walter E. Burton, Akron, Ohio.*

Flower Pot Makes Lamp Base

DRESS up your yard or garden with an attractive light like this one. It's an ordinary hand lantern, electrified and mounted on an upturned flower pot. Use waterproof cable and a waterproof socket. Run the wire through the hole in the base of the pot. You can wire it as a movable, plug-in fixture, or make a permanent lamp out of it. —*Walt Wybell, Westfield, Mass.*

Lamp for Lawn Umbrella

IF YOU like to sit outdoors after dark on summer nights, here's a simple indirect-lighting arrangement. It's a swivel socket on a bracket, a weatherproof gasket, and a 150-watt, sealed-reflector lamp. Mount the lamp socket so it points upward.

Corn Popper Roasts Wieners

IT'S fun roasting wieners on long-handled forks, but the meat frequently slides off into the ashes when the tines get hot. To avoid this annoyance, I use a long-handled, mesh-type corn popper to hold the wieners. Embers, of course, are preferable for roasting the dogs without burning them.—*Charles H. Hardy, Los Angeles, Calif.*

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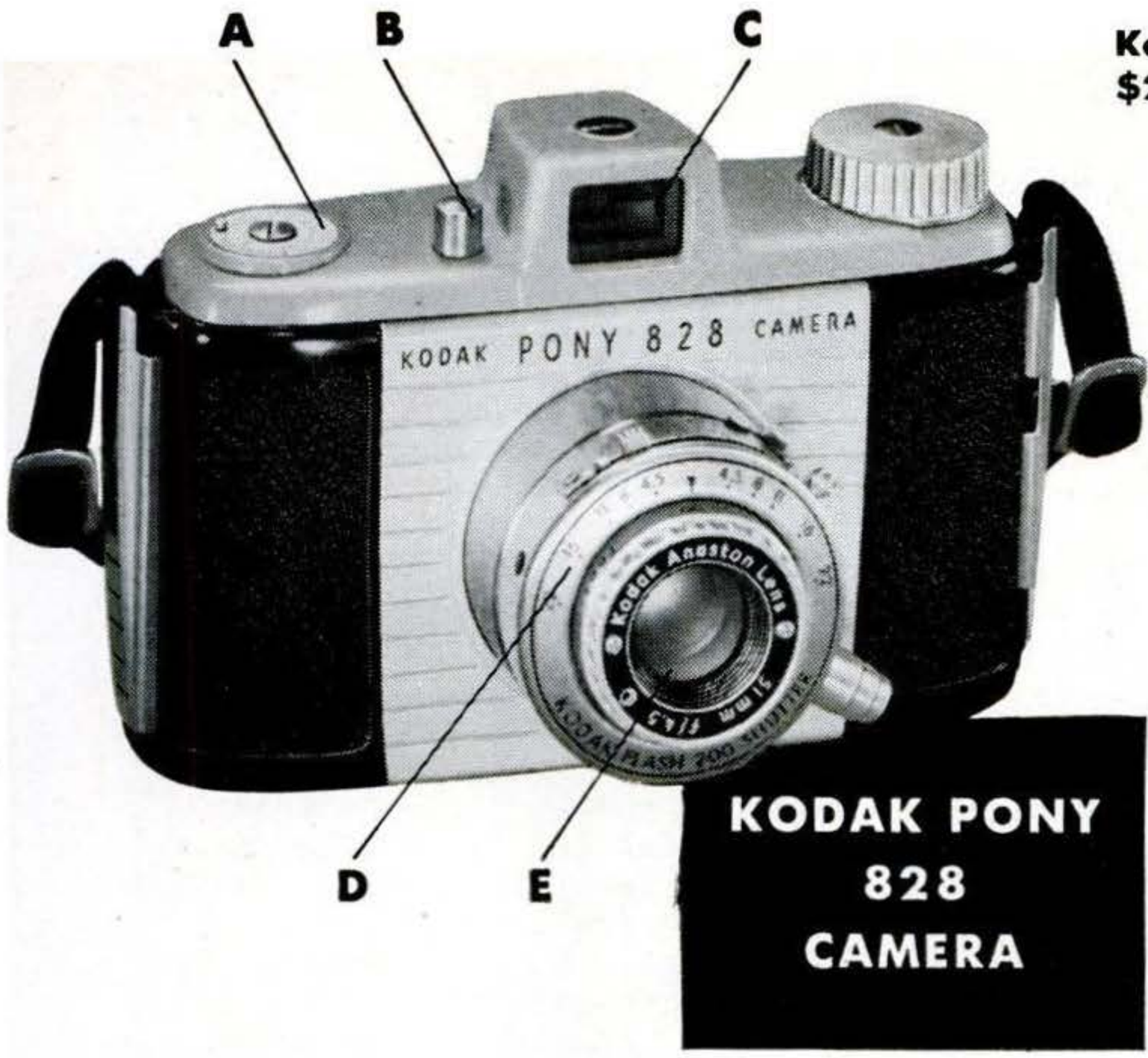

KODAK PONY 828 CAMERA

Kodak's newest f/4.5 miniature $29.95, including Federal Tax

Just look at these fine-camera features—and *then look at the price.*

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B Finger-tip shutter release.

C Enclosed optical eye-level view finder, large and brilliant.

D Telescoping lens barrel with easy-to-read lens and shutter speeds, depth-of-field and focusing scales . . . simplified average exposure settings marked in red.

E Color-corrected Kodak Anaston f/4.5 *Lumenized* Lens, in Kodak Flash 200 Shutter with built-in synchronization.

See the Pony 828 accessories, too, at your Kodak dealer's—tan leather Field Case for $6.50; Kodak Flasholder for $11.08, including Federal Tax; as well as Kodak Combination Lens Attachments and Kodak Metal Cable Releases.

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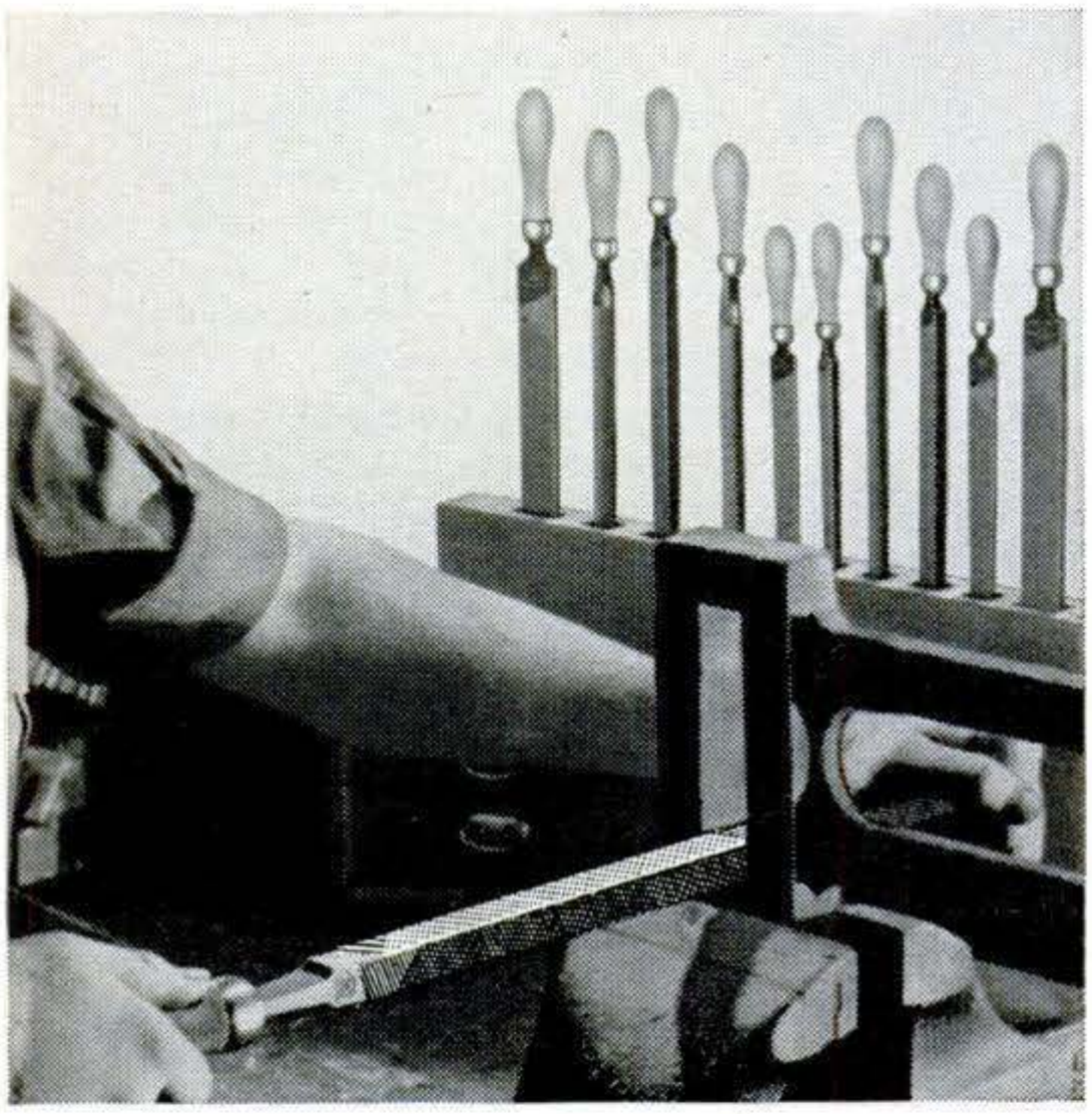

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Mechanics of Farming

By Ladd Haystead

■ Surprising even to farmers is the finding of a recent U. S. Dept. of Agriculture survey that one out of four farms in the country has a trailer. Nearly half have either a truck or a trailer. These carry 45 percent of all farm tonnage to market. Another 30 percent is hauled by hired equipment; 22 percent, on buyers' equipment. This helps explain falling railroad revenues.

■ Five-operations-in-one is announced for the Sure-Stand® grass-seeding, fertilizing, and pulverizing grain drill (Brillion Iron Works, Inc., Brillion, Wis.). In various combinations, it fertilizes the soil, pulverizes and packs, and drills in cereal grains and legume and brome grass.

■ A 1-1/4-hp. power mower slung from the operator's shoulder, called the Scythette® (Garden-All Tractor Inc., Liberty, Ind.), has a rope starter and a 20-inch cutting head.

Complete maneuverability is claimed, making it especially useful for close quarters around walls, grave markers, monuments, and hedges, and for trimming weeds under water.

■ Power-operated cotton-stalk cutters are now being developed in Texas by private individuals and Texas A. & M. One development is an attachment for the cutter, driven by a power take-off, that cuts the stubble about two inches below the

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Winning Fresh Laurels

PATENTED **CORALOX** INSULATOR

MORE NEW CARS AND TRUCKS ARE EQUIPPED WITH AC SPARK PLUGS THAN ANY OTHER MAKE

AC's patented Insulator—*CORALOX*—is winning fresh laurels from car, truck and tractor owners, because it eliminates the major causes of spark plug trouble.

CORALOX is AC's Insulator. It conducts heat 4 times as fast as previous insulators—has 10 times the insulating value at high temperatures—is 3 times as strong—does not attract oxide coating.

That's why AC Spark Plugs perform better at any engine temperature—have greater resistance to fouling—have more scientifically shaped insulator tips—have wider Heat Range per plug.

For easier starting—better idling—faithful firing under heavy loads — use the new AC's with patented *CORALOX* Insulator.

AC SPARK PLUGS

AC OIL FILTERS AC FUEL PUMPS

preferred on millions of vehicles

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

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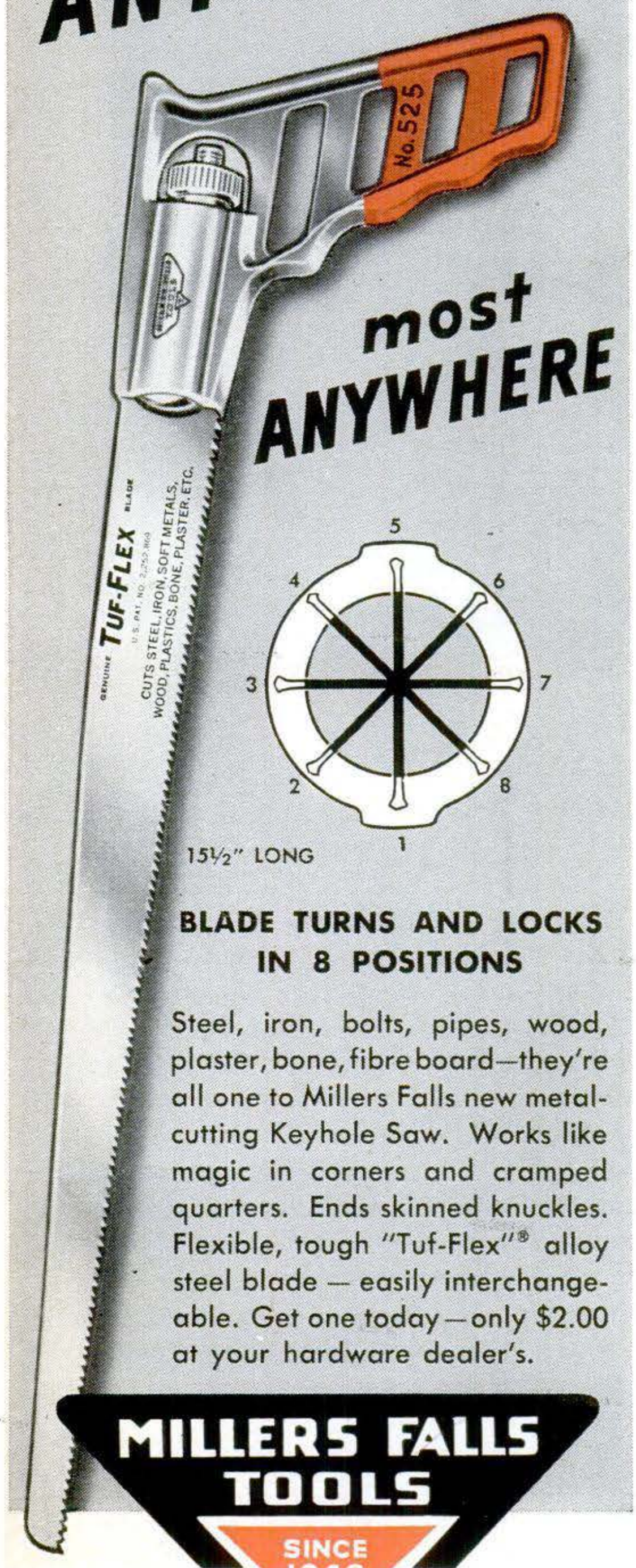
Cuts most ANYTHING—



BLADE TURNS AND LOCKS IN 8 POSITIONS

Steel, iron, bolts, pipes, wood, plaster, bone, fibre board—they're all one to Millers Falls new metal-cutting Keyhole Saw. Works like magic in corners and cramped quarters. Ends skinned knuckles. Flexible, tough "Tuf-Flex"® alloy steel blade — easily interchangeable. Get one today—only $2.00 at your hardware dealer's.

MILLERS FALLS TOOLS

SINCE 1868

MILLERS FALLS COMPANY GREENFIELD MASS.

surface of the ground. This reduces the length of the root stubble, which interferes with planting, cultivating, and machine harvesting. Six benefits are listed by Prof. H. P. Smith, of Texas A. & M.: the machines chop material better; chopped material decays faster; soil condition is improved; ripening of some weed seeds is prevented; insects are destroyed at hibernation time; winter cover crops can be planted earlier.

■ IPC (isopropyl N phenyl carbamate), weed-killer announced in 1946, has been up and down in agricultural scientists' opinion several times. As recently as August 1949, the Department of Agriculture announced that it was not a commercial success. But the California Experiment Station has found that under certain rainfall conditions (too little fails to carry solution to the roots; too much carries it away) IPC can be useful in controlling weeds in ladino clover if applied when the weed is still a seedling.

■ Ultrasonics may be the answer to pest infestations of stored farm crops. Work now going on at Cambridge, Mass., indicates weevils or molds in silage may be destroyed by the high-frequency sound waves.

■ The huge job still to be done by agricultural chemists is indicated by recent Department of Agriculture estimates that the annual loss from plant diseases is $2 billion, annual loss from all insects $4 billion. The latter includes loss by cotton insects, $743,214,000; cereal and forage insects, $892,240,000; forest insects, $5,500,000; fruit insects, $70,000,000; household insects, $60,000,000; livestock pests, $396,-500,000; and truck-crop insects, $193,327,000.

■ Modern materials-handling, which makes possible mass production in industry, was born on the farm with the invention of the overhead manure carrier. Yet today materials-handling on the farm, for the most part, is as antiquated as the spinning jenny would be in industry.

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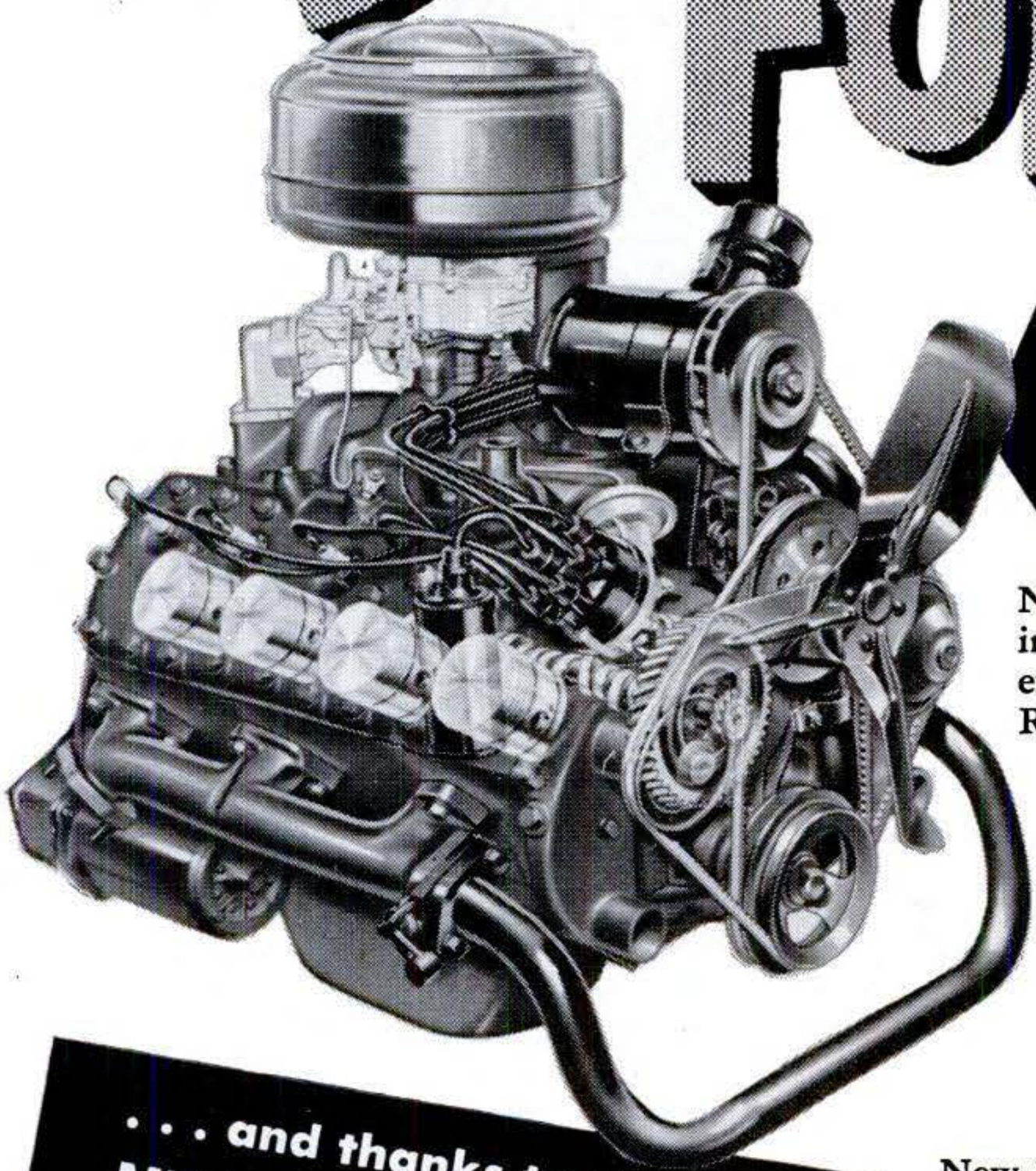
Feels like America's costliest cars—

the '50 FORD

Its Quiet whispers Quality...



thanks to the super-quiet
100-h.p. V-8 ENGINE

New "super-fitted" pistons with steel struts in cam-ground skirts to control expansion, permit closer clearances. Result—longer life, extra quiet.

New "hushed" laminated composition timing gear meshes with metal gear on crankshaft for practically noiseless operation.

New "quiet-contoured" camshaft lobes soft-pedal valve action.

Perma-quiet valve assemblies with one-piece valve guides and shot-peened valve springs require no adjustment, operate more quietly.

New 3-blade, silent-spin fan cools with maximum efficiency and minimum sound.

. . . and thanks to the
NEW "HUSHED" RIDE

. . . a "Mid Ship" Ride away from the wheels, in the 13-ways stronger "Life-guard" Body that's "sound-conditioned" against road noise, and cradled on "Hydra-Coil" and "Para-Flex" Springs that soak up the bumps.

"Test Drive" the '50 FORD

AT YOUR FORD DEALER'S

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Springtime is time to add Pyroil

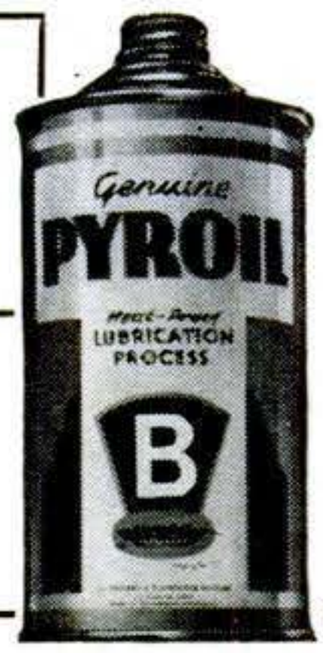
This is fun and fancy-free time for you and your car. To make sure it's trouble-free time, too—give your car the added protection of Pyroil. Pyroil is a "must" for Springtime driving—when the open road invites added miles which add extra wear and tear, extra exposure, extra friction on metal parts.

Pyroil, with its remarkable property of making oil adhere to all metal surfaces, assures constant lubrication. That's why Springtime is time to add Pyroil—add miles of trouble-free driving to your car.

Pyroil for Aircraft Engines

Use Aircraft Pyroil B for lubricating oil, Aircraft Pyroil A for gasoline.

GIVEN! An attractive Pyroil metal savings bank—takes coins up to 50c pieces. MOTORISTS, it's yours for the asking—sent postage paid.



Manufactured and Guaranteed by
PYROIL COMPANY,
483 Main Street
La Crosse, Wisconsin.
Canadian Distributors:
Central Purchasing Agencies, Ltd.
Toronto, Ontario

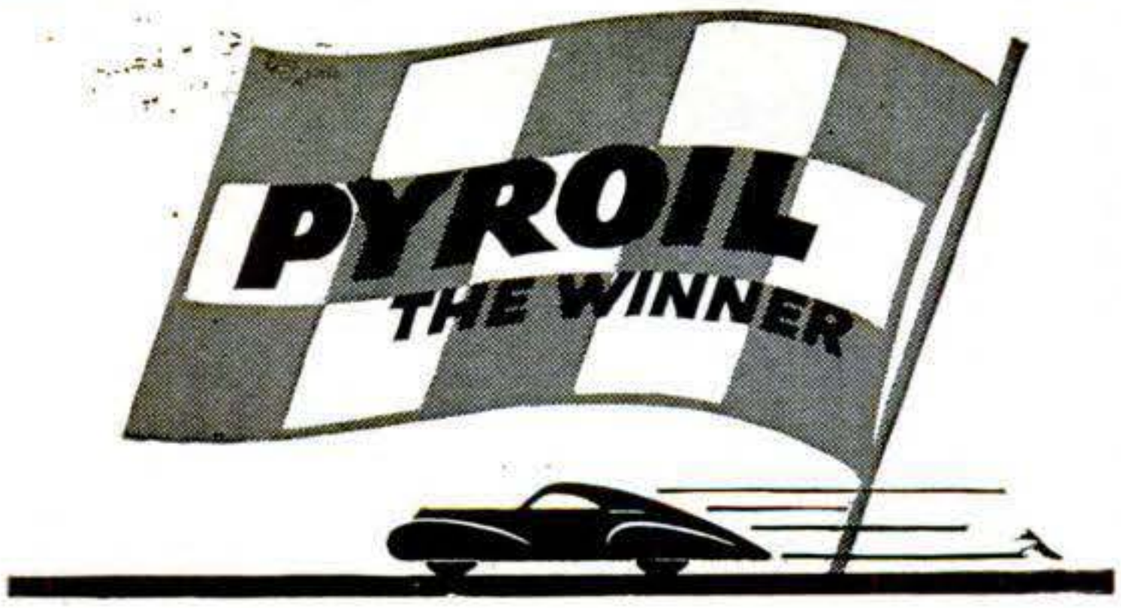
PYROIL COMPANY
483 Main Street, La Crosse, Wisconsin

I want my car to last and run properly. Please tell me more about Pyroil and how it can accomplish this for me.

Name.....

Address.....

City or Town.....*State*.....



Army Offers Films For Free Showing

THE U. S. Army has many 16-mm. sound films available for nonprofit, nontheatrical, educational screenings. The following titles are among those that may be borrowed from your nearest Army Area headquarters. Previous issues of PS have listed films from the Navy and Air Force.

"Combat Report." This film seeks to illustrate what it takes, besides an efficient bomb crew and a load of explosives, to sink a submarine. Running time 13 minutes.

"Road to Berlin." A shipment of supplies is followed from the time it leaves a depot in the United States until it reaches the fighting front by way of U-Boat infested seas. Running time 20 minutes.

"Life Line." This film highlights the medical supply system of the Army. Running time 17 minutes.

"Film Communique—Fourth Issue." A newsreel film containing three sequences. "Aerial Technique" illustrates skip-bombing and parafrags in operation over New Guinea. "Roll of Honor" is a pictorial tribute to American engineers who built an airstrip at Munda. "Fifth Army" presents Gen. Mark Clark. Running time 20 minutes.

"Film Communique—Fifth Issue." Five separate sequences "P-47s Come to Town" shows aircraft being uncrated in England and put into the air. "Two Million Dollar Hill:" That's the cost of the ammunition we poured into it before the Germans gave up. "Hawaiian Jungle Training" shows the Ranger Combat School being inspected by Gen. Marshall. "A Few Quick Facts" is an animated cartoon. "Bloody Tarawa" is an account of the Marine Corps assault on the little island. Running time 20 minutes.

"Film Communique—Seventh Issue." Three separate sequences. "Burma Outpost," where men perched up in the hills are supplied by parachute. "The Home Front," animated cartoon starring Private Snafu. "What Makes a Battle?," the invasion of the Marshall Islands. Running time 20 minutes.

"Earth Movers." Heavy equipment: bulldozers, steam-shovels, and cranes in use by the Corps of Engineers and the Seabees in action on all fronts. Running time 14 minutes.

"Birth of the B-29." The story of the development of the weapon that broke the back of Japan's main islands. Running time 21 minutes.

"Weapons of War." Shows the softening up and taking of the Japanese-held island of Guam. Other sequences show our Chinese allies constructing and leveling huge airfields practically with their bare hands; a paratroop operation is included. Running time 20 minutes.

"Back Door to Japan." A story of how General Frank Merrill's jungle fighters, famous as "Merrill's Marauders," captured the Burma Air Base at Myitkyina. Running time 17 minutes.

"The Battle of Peace." About the U.S. Military Government in Germany. The methods that were established for rebuilding and rehabilitating German cities are shown. Running time 19 minutes.

"A Tale of Two Cities." The two cities are Hiroshima and Nagasaki. The devastation wrought by the atomic bomb on these cities is illustrated in this film. Running time 12 minutes.

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"Fishin' Foursome" by EVINRUDE

● Four great fishing motors, built for trouble-free years of fishin' fun. One is *right* for you . . . right for your boat, your kind of fishing. The "big two" are brand new . . . and pretty special any way you look at them! New Fleetwin with Duo-Clutch gives you new handling ease . . . you start in Neutral, "idle" when you like! New Fastwin gives you Gearshift control with Neutral-Forward-Reverse! For smaller boats, the Sportsman and Sportwin with Evinrude's famed Fisherman Drive that "lets you go wherever there's water to float your boat." See your Evinrude dealer . . . look for his name under "Outboard Motors" in your classified phone book.

Send today for free catalog of the complete Evinrude line of six models. Address . . .

EVINRUDE MOTORS
4483 N. 27th St., Milwaukee 16, Wis.
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Evinrude Motors, Peterboro, Ontario

★ **SPORTSMAN** 1.5 H.P.* For small fishing boats. Full Pivot Reverse, *Simplex Starter, Fisherman Drive.

★ **SPORTWIN** 3.3 H.P.* Smooth alternate firing twin . . . finer than ever for '50! Full Pivot Reverse—Transom Trigger—Fuel Gauge—Fisherman Drive.

★ **FLEETWIN** 7.5 H.P.* . . . weighs only 45 pounds. New Duo-Clutch for Neutral starting and idling and Safti-Grip Propeller Drive—no pin to shear!

★ **FASTWIN** 14.0 H.P.* Gearshift Control with Neutral-Forward-Reverse. Separate Cruis-a-Day Tank provides capacity for a full day of "stop-and-go" fishing without refueling.

Send for FREE catalog

*O.B.C. certified brake H.P. at 4000 R.P.M.

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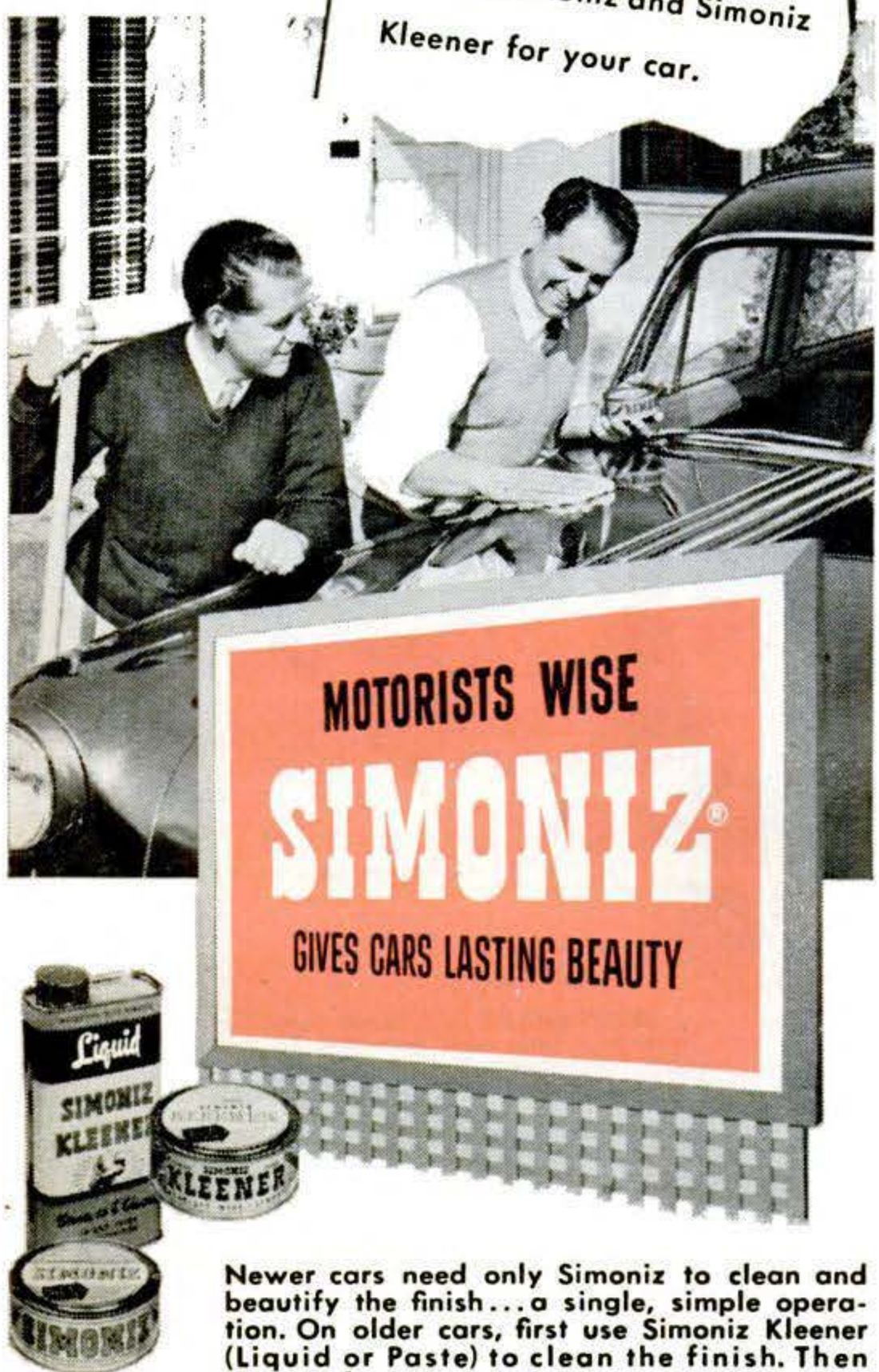
WHY WASTE TIME...

with "temporary polishes?"

Simoniz gives lasting beauty and protection to the finish — with fewer applications!

The amazing sparkle Simonizing gives your car lasts for months... protects and preserves the finish... keeps colors from fading! Always insist on world-famous Simoniz and Simoniz Kleener for your car.



Newer cars need only Simoniz to clean and beautify the finish... a single, simple operation. On older cars, first use Simoniz Kleener (Liquid or Paste) to clean the finish. Then Simoniz for lasting beauty.

THE SIMONIZ COMPANY, CHICAGO 16, ILL

The sooner you Simoniz your car the better!

"Pacific Pathway." Film gives an up-to-date pictorial review of the islands from Australia to Japan that American troops used in their fight to victory under General MacArthur in the Pacific War. Running time 20 minutes.

"Korea Today." Describes present-day occupation in Korea, with special emphasis on progress made thus far by the American occupation authorities. Running time 19 minutes.

"Problems of Peace in Europe." Illustrates America's co-operation in a comprehensive European recovery program—the Marshall Plan. Describes how the European nations tie into each other. England must export; France must modernize agriculture and get coal; Norway can export timber and fish; Italy must modernize her agriculture and industry. Running time 20 minutes.

"The Price of Rendova." A pictorial review of one of the bloodiest battles our forces fought in the Pacific during World War II. Running time 11 minutes.

"To the Ladies." This film is a plea to women for help in caring for war wounded in the Army's hospitals. It shows the members of the Women's Army Corps who volunteered to serve in the Army Medical Department as hospital technicians. Running time 15 minutes.

"Eve of Battle." Shows a cross-section of some of the activity on the eve before the forces of the Allies hit the beaches of Normandy during World War II. Running time 20 minutes.

"The Government of Japan." Film is composed of captured and prewar Japanese movies that illustrate the nature of Japan's government and the filial devotion demanded by both the Emperor and the State. Running time 18 minutes.

"The Transportation and Communication Systems of Japan." This film presents the many aspects of both modern and primitive transportation. The Japanese have succeeded in establishing good rail service, two-thirds of which is state-owned. Various views of rail facilites are shown as well as the communicatons system, which is subsidized by the Japanese government. Running time 30 minutes.

"Home Life and Social Customs of the Japanese." A presentation of their ancestral customs, formalities of worship, recreations, business routines, and educational training. Emphasizes the ever-present struggle between ancient and modern ways of life. Running time 37 minutes.

"Diary of a Sergeant." This film traces the treatment and rehabilitation of Sgt. Russell, an amputee in an Army hospital, showing his skillful manipulation of artificial arms and hands. Sgt. Russell, who lost both hands on D-Day 1944, was given a role in Goldwyn's "The Best Years of Our Lives." Running time 22 minutes.

"The Atom Strikes." Beginning with the atom-bomb tests in New Mexico, the film shows the subsequent bombing of Hiroshima and Nagasaki, and the utter ruin caused to buildings of various types, including bridges, factories, and roads. Running time 31 minutes.

"Ground Team." A film record depicting the great achievements of the infantry, artillery, and airborne troops during World War II. It shows how these divisions used coordinated action and teamwork to push ahead despite stubborn enemy resistance. Running time 9 minutes.

"Hell for Leather." Film illustrates the history of the First Cavalry Division. It shows jungle fighting in the tropics. This division was the first to enter Leyte and Tokyo. Running time 10 minutes.

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Look What I'm Learning

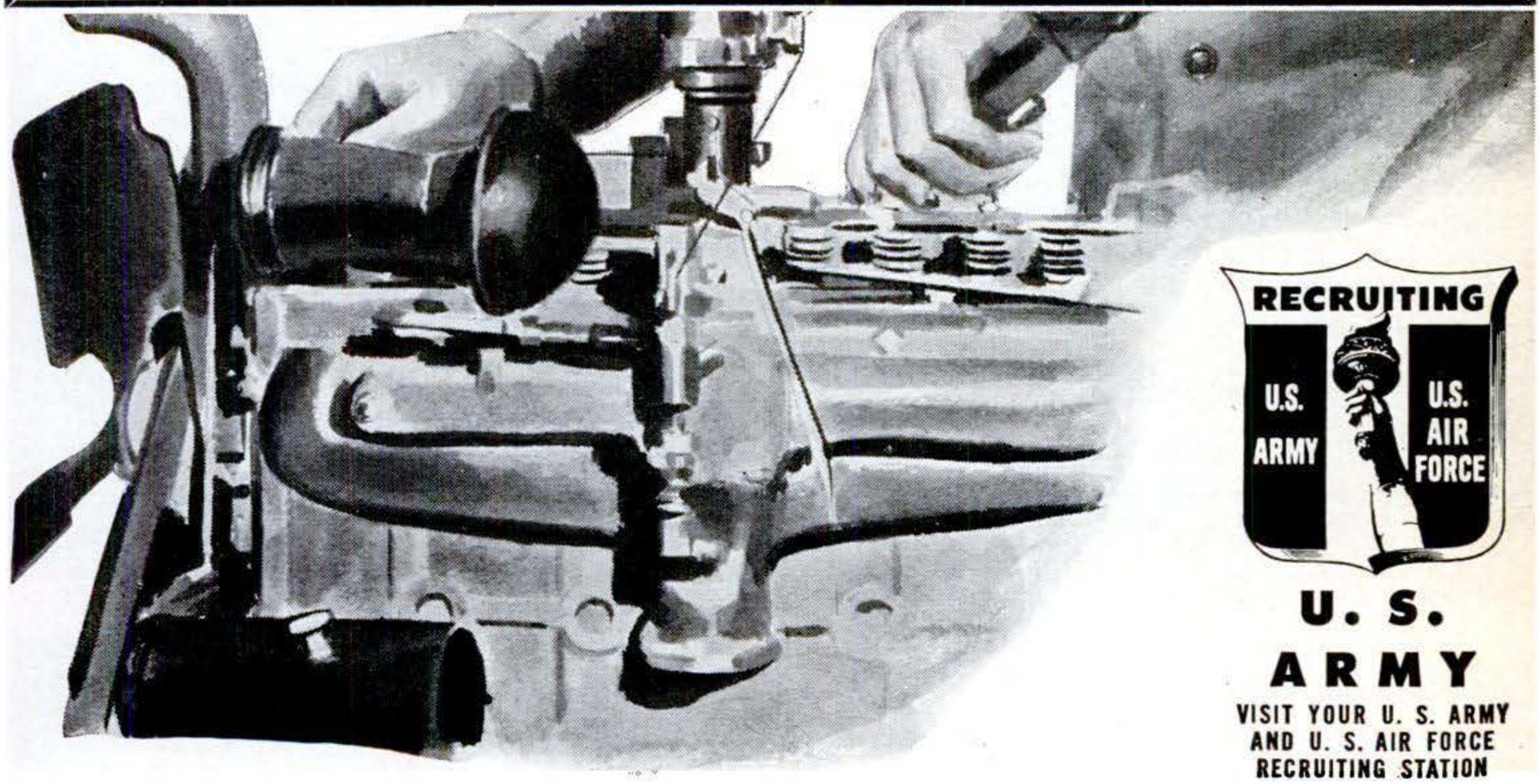
—AND EARNING, TOO, IN A U. S. ARMY SPECIALIST SCHOOL

Choose Your Own Course to Train for a Career with a Future

Look over these Army Specialist Training courses with your own future in mind. Under the new U. S. Army Career Plan you can discover your best abilities, earn while you learn, and prepare yourself for a satisfying career in a field you are suited for. Opportunity for advancement, earnings you can *bank*, a secure and congenial way of life —all can be yours in today's Army. Get details at your nearest Recruiting Station.

HERE ARE SOME OF THE COURSES AVAILABLE:

- AUTOMOTIVE MAINTENANCE
- MEDICAL EQUIPMENT REPAIRMAN
- LOCOMOTIVE REPAIRMAN
- CONSTRUCTION EQUIPMENT MECHANIC
- OFFICE MACHINE SERVICE MAN
- MARINE ENGINE MECHANIC
- ELECTRICIAN
- WATER SUPPLY TECHNICIAN
- TIRE REBUILDER
- CONSTRUCTION MACHINE OPERATOR
- TELEPHONE AND TELEGRAPH INSTALLER REPAIRMAN
- TELETYPE REPAIRMAN
- SURGICAL TECHNICIAN
- MAP REPRODUCTION
- WATCH REPAIRMAN
- FIRE CONTROL INSTRUMENT REPAIRMAN
- LEADERSHIP COURSE



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BUILD A BUNKROOM

REMODEL THE ATTIC

with the WESTERN PINES*

Rugged, he-man quarters for your young buckeroos are a cinch to build with colorful, easy-to-work Western Pines*. Or turn an idle attic into a cozy and hospitable guest room by building double-deck beds of these attractive, economical woods.

The smooth textures and straight, even grain of the woods of the Western Pines*—the wonderful way they grip paint, stain or wax—make them a joy to use on any workshop project. Cabinets, bookcases, tables, built-in fixtures for kitchens or rumpus rooms take on beauty and character from these glowing woods. They have long been favorites with home craftsmen who take pride in turning out a variety of useful and attractive home furnishings.

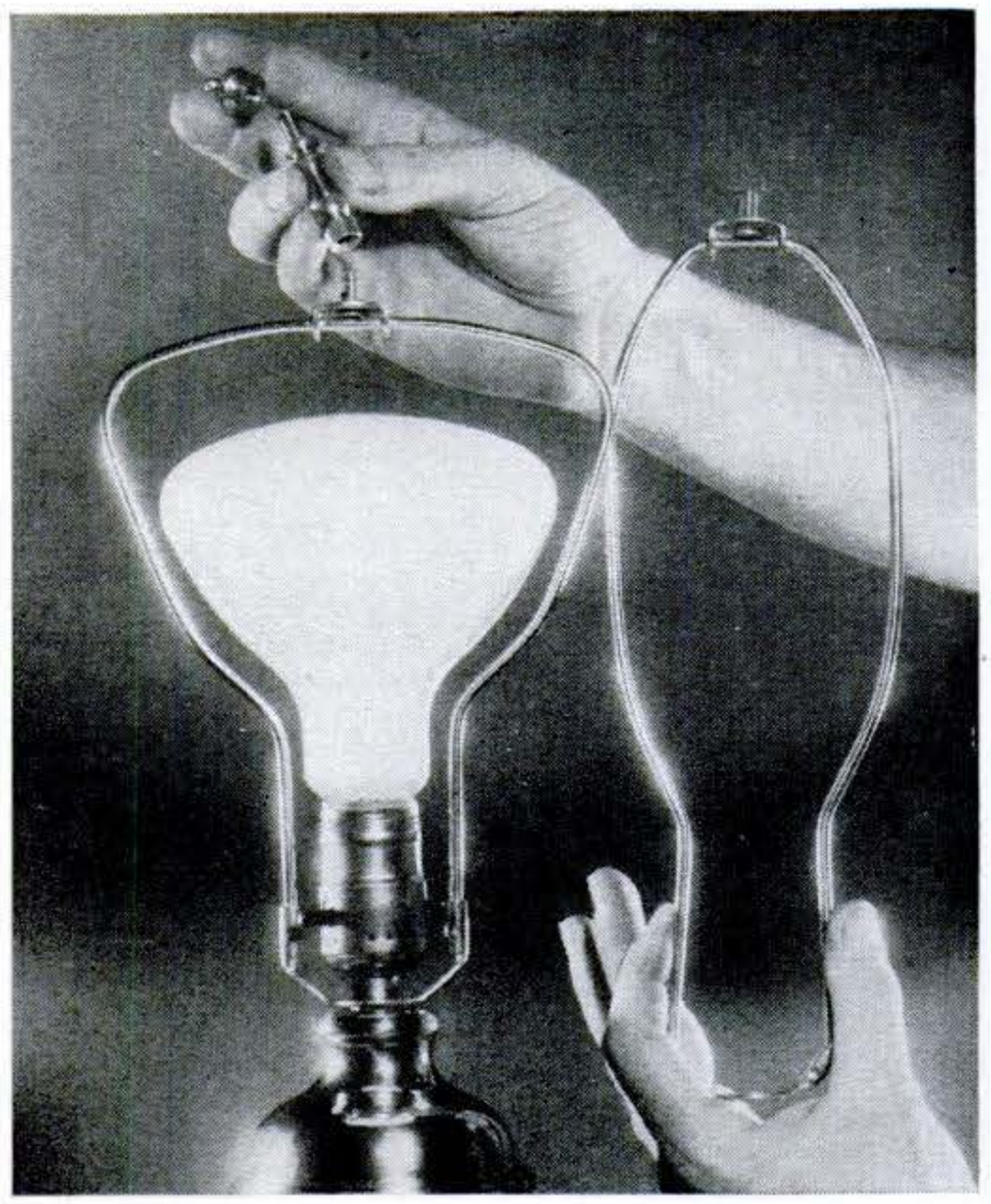
SEND FOR FREE IDEA PACKET No. 309!

Shows you how, with a little planning and ingenuity, you can work wonders all through your home with the versatile Western Pines*—and have fun doing it. Contains new, colorful illustrated booklet, "Enchanting Homes of Western Pines," "Bunk Bedroom Details," "How to Treat Knotty Pine Paneled Walls," etc. Write to Western Pine Association, Dept. 309-L, Yeon Bldg., Portland 4, Oregon.

These are the Western Pines
*** IDAHO WHITE PINE**
*** PONDEROSA PINE**
*** SUGAR PINE**

"The Fighting First." Shows the First Infantry Division participating in eight campaigns and three invasions during World War II. Running time 15 minutes.

"Task Force Frigid." A pictorial record of a military exercise, held in the vicinity of Ladd Field, Alaska, that tested the operating efficiency of men and equipment in extremely cold, dry climate. Running time 37 minutes.



Kit Modernizes Old Lamps

YOUR handsome old table lamps can be made good to see by as well as good to look at through the use of a modernizing kit manufactured by Noma Electric Corp., New York. The kit contains a wide harp that will accommodate a 150-watt indirect-light bulb, and a riser for extending shade height if necessary. Westinghouse lighting experts recommend the use of this bulb on lamps over 12 inches high and having shades over 14 inches in diameter. The harp parts sell for 50 cents.

Auto Fuel Pump Bails Bilge

TROUBLED by a small amount of leakage in my 18-foot inboard, I built an inexpensive drain system around an electric fuel pump purchased from an auto-supply store. I bolted the pump to a beam and wired it through the ignition switch so that it is turned on whenever the engine is. The pumping lines are two lengths of rubber hose. The inlet rests on the bottom of the boat, and the outlet runs over the side.—*Bob Barton, Detroit, Mich.*

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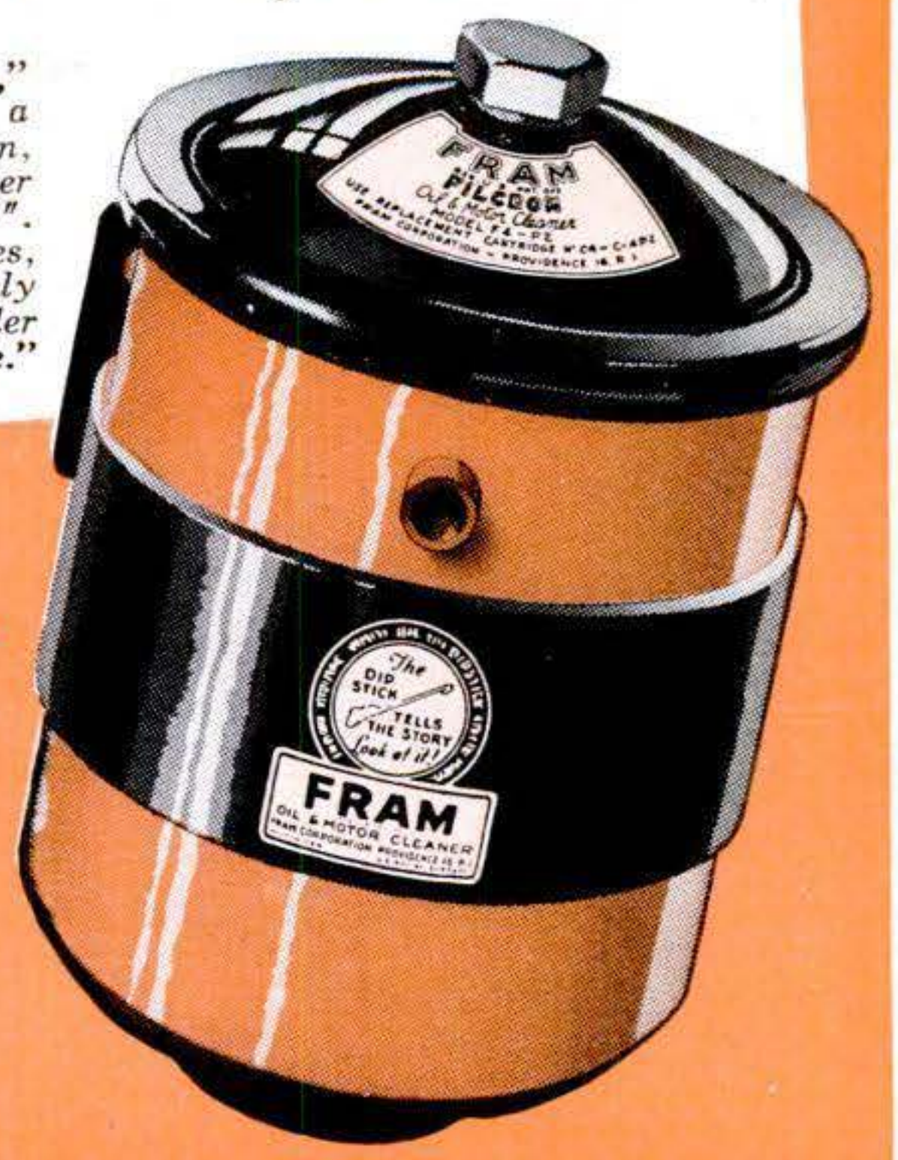
Negligible Engine Wear After 80,000 Miles

"My car was driven 80,000 miles before engine overhaul," says California motorist. "It was equipped with a Fram Oil & Motor Cleaner. When I tore motor down, only sludge was below oil pump about 5" in diameter and ¼" thick. Greatest wear on crankshaft was .0005". Reassembled motor using new rings, valves, guides, standard bearings. Later, on 3000 mile trip, added only one quart of oil. Now have 115,000 miles. Consider Fram Oil & Motor Cleaner best investment I ever made."



How the Fram Oil & Motor Cleaner Works...

Now in use on over 12,000,000 cars, the famous Fram Oil & Motor Cleaner "cleans the oil that cleans the engine." Reduces engine wear and extends engine life by removing harmful dirt, dust, grit, sludge and abrasives from your oil. Outside-in flow assures greatest filtering area. Large sump area increases cartridge life . . . allows heavy dirt, carbon and metal particles to settle to bottom of filter where they can be easily removed.

Famous Fram Filcron Cartridges are the working part of the filter. Remove harmful particles down to one micron (.000039") in size. Offer highest clean oil flow rate. maximum dirt capacity, longer cartridge life, lowest clean oil cost per mile. Exclusive non-abrasive filtering media . . . positively will not remove additives from compounded oils. Can be changed easily . . . quickly . . . economically when effective life is spent.

Now FRAM Offers You Complete Engine Protection

Call WESTERN UNION by number and ask for OPERATOR 25 for the name of your nearest FRAM DEALER

Engineers have proved that internal combustion engines are the cause of their own destruction. With each explosion in every cylinder, combustion by-products in the form of blow-by gases are forced past the rings into the crankcase. Water vapor, carbon, and corrosive *acids* attack vital moving parts . . . contaminate the oil to make sludge. Results in fouled rings, sticking valves, lost power.

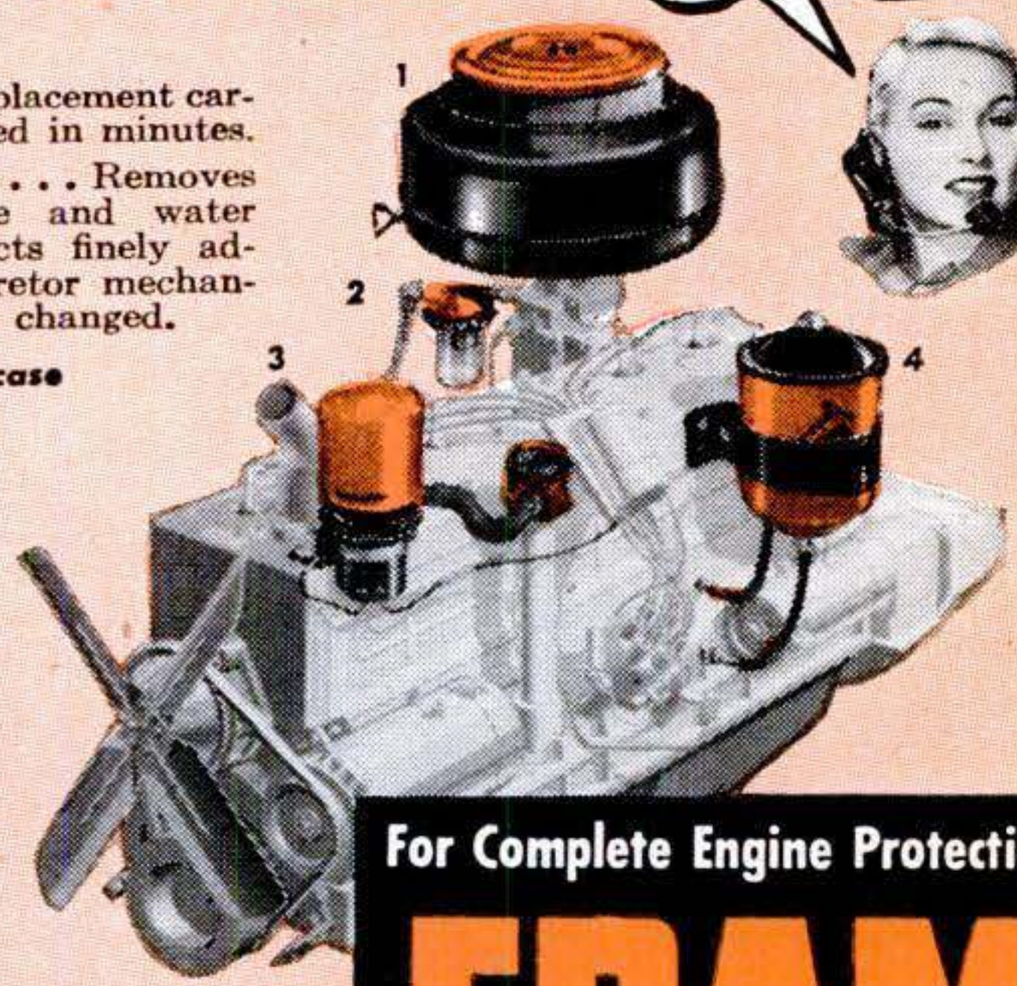
Besides these internally manufactured contaminants, dirt, dust, grit and abrasives enter through the carburetor air intake and the crankcase breather to grind and score mirror-finished engine surfaces. Gas tank condensation and sediment, plus scale, jams carburetor needle valves.

To prevent all these engine killers from cutting miles off your car's life, Fram offers you Complete Engine Protection . . . four great Fram Filters that seal out damaging abrasives and remove internally-manufactured corrosives as fast as they form.

1. Fram Carburetor Air Filter . . . Uses completely new, more efficient method to clean the air your engine breathes. Exclusive Fram-Tex dry filtering media removes harmful dust from air before it enters engine. Easily installed. Low cost replacement cartridge. Can be changed in minutes.

2. Fram Gasoline Filter . . . Removes dirt, sediment, scale and water from gasoline. Protects finely adjusted modern carburetor mechanisms. Cartridge easily changed.

3. Fram Positive Crankcase Ventilator . . . Combines a Fram Crankcase Air Filter with an electrically-driven blower. Provides continuous, uniform crankcase ventilation with clean, filtered air to remove corrosive blow-by gases as fast as they are formed. Seals crankcase against entry of dirt at all points. Flexible air hose and special cap fit on oil filler pipe. Cartridge can be changed in 30 seconds.



4. Famous Fram Oil & Motor Cleaner . . . as described above

Put all four of these Fram engine-savers on your car for Complete Engine Protection. For the name and address of your nearest Fram Dealer, call Western Union by number and ask for OPERATOR 25. **FRAM CORPORATION, Providence 16, R. I. *In Canada:* J. C. Adams Co., Ltd., Toronto, Ontario.**

For Complete Engine Protection

FRAM

OIL - AIR - FUEL

FILTERS

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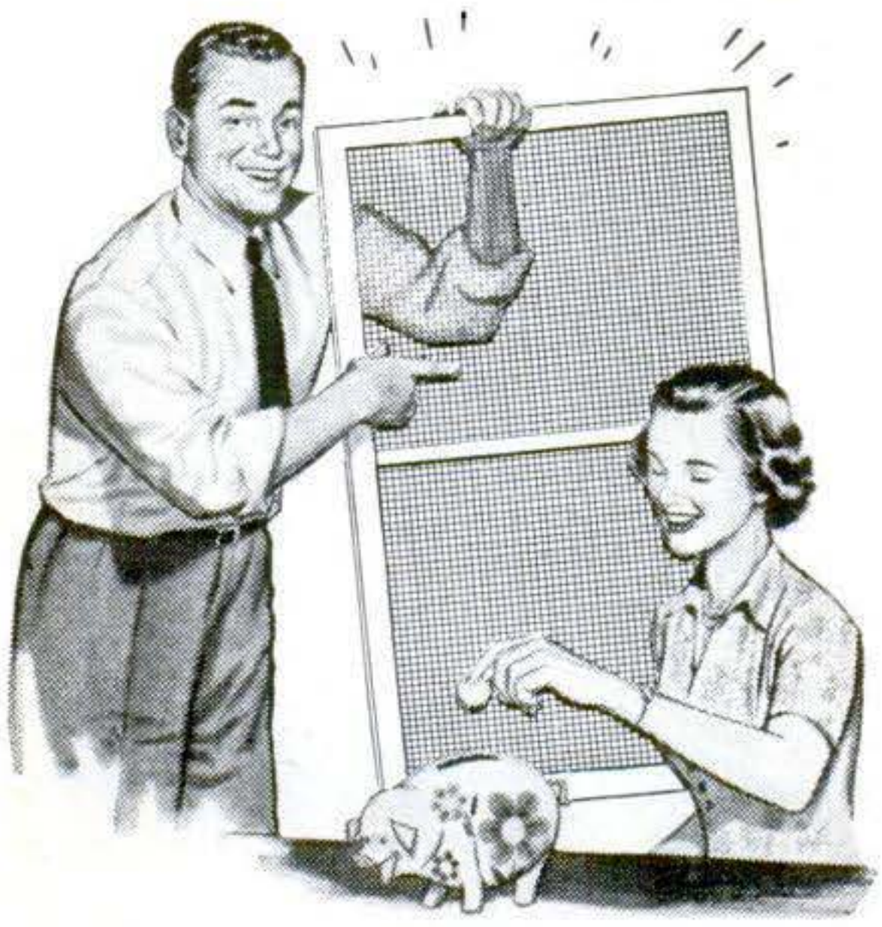
Screen costs are SLIGHT



with LUMITE saran screening!

because it's . . .

RUSTPROOF Guaranteed never to rust, rot or mildew . . . unaffected by salt air or smoke, rain, snow or industrial fumes! It's the ideal screening for every exterior use.

STAINPROOF Lumite is guaranteed stainproof because it's rustproof. It never needs protective painting. It cleans easily.

LASTS AND LASTS Lumite offers long range economy . . . costs only 11½ to 12¢ a square foot . . . when adequately framed gives years of trouble-free screen protection! Sold by hardware, lumber, and building supply dealers.

LUMITE* SARAN SCREENING

*Registered Trade-mark

SEND FOR *FREE* SAMPLE TODAY

PS-5

LUMITE DIVISION,
Chicopee Manufacturing Corp. of Ga.
40 Worth Street, New York 13, N. Y.

Please send me information and FREE sample of Lumite Screening.

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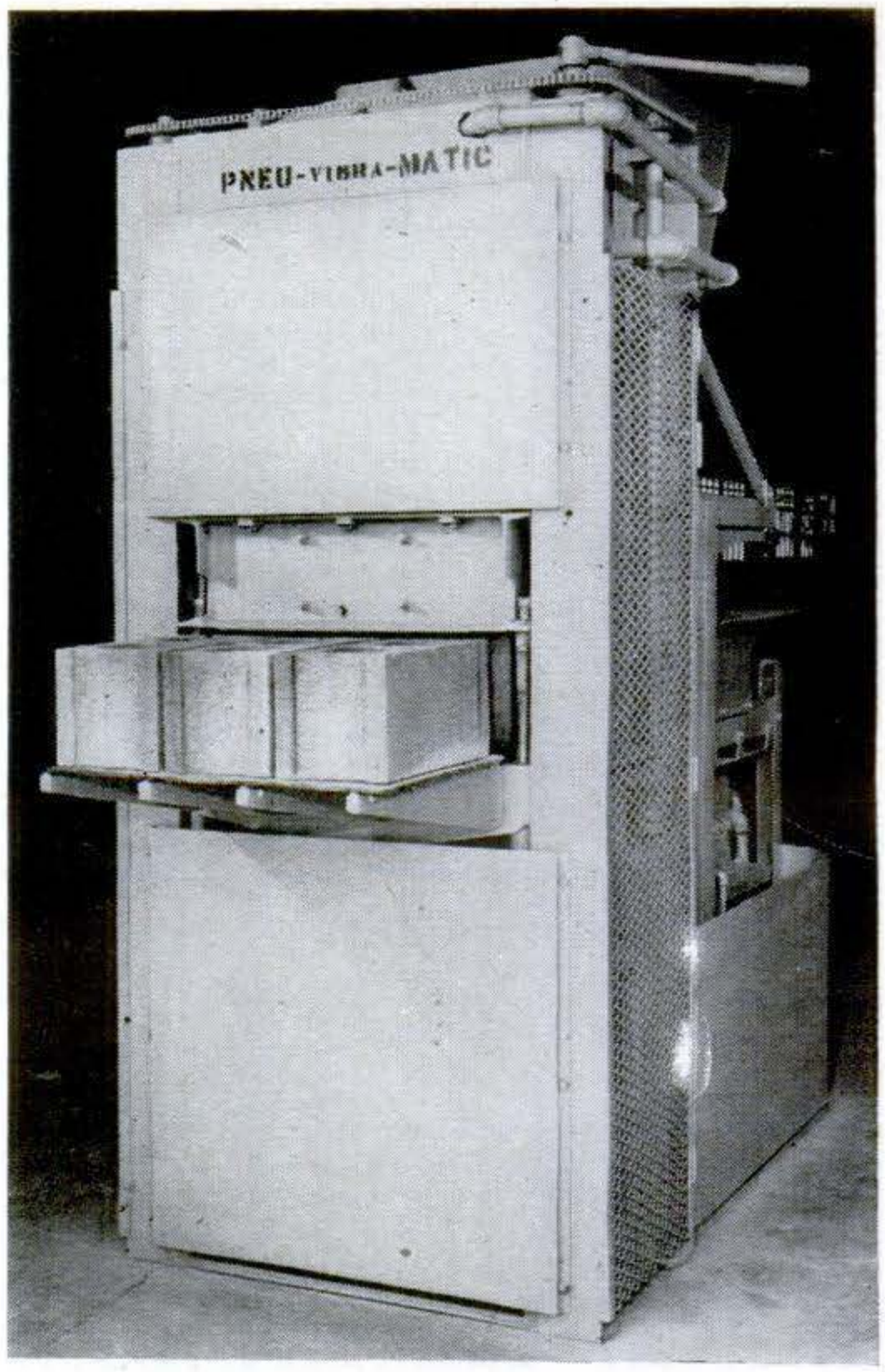
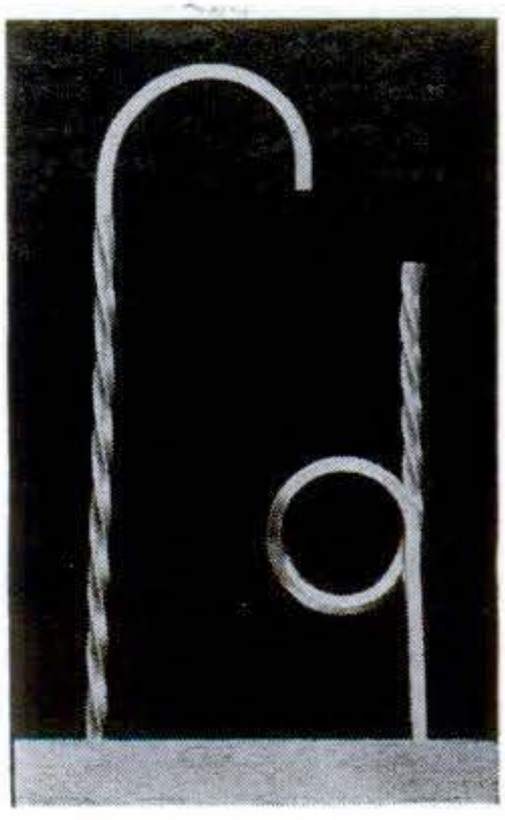


Machine Makes Cement Blocks

THIS small, compact, completely automatic machine can turn out 12 uniform cement blocks a minute—or enough in two and a half hours to build a five-room house. Made by the Crawford Industries, of Pomona, Calif., the Pneu-Vibra-Matic® operates on 220 volts and requires an external source of air at a pressure of 80 to 120 pounds. Sturdily built, the machine has interchangeable molds for making tiles, bricks, or blocks, and screening protects all danger points.

Cast Iron Bends and Twists

THESE intricately shaped rods are the result of a new process that produces cast iron with several times the strength and ductility of ordinary cast iron. Made by adding magnesium to molten iron, it was developed by the International Nickel Co., New York City.



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SUMMER AHEAD

INSTALL NEW

CHAMPION

SPARK PLUGS

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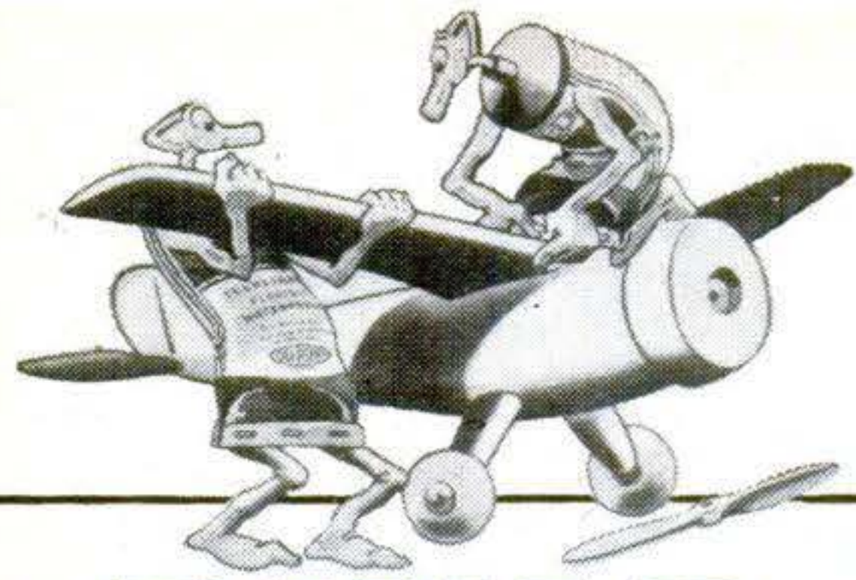

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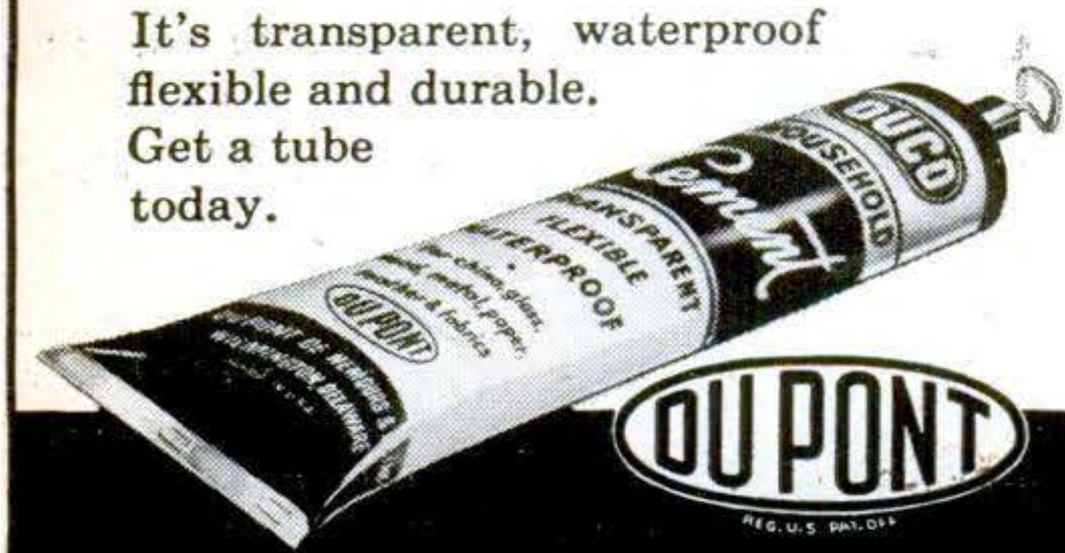
STRONGER MODELS

It's transparent, waterproof flexible and durable. Get a tube today.



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BUILD AN EXTRA ATTIC ROOM

HERE'S the quick, low-cost way to build an extra bedroom or two in your attic. Nail big, fireproof panels of Gold Bond Gypsum Wallboard right to the studs or over the old material. Gold Bond Gypsum Wallboard saws like lumber, **resists moisture, won't expand, contract or warp. Seal joints with Gold Bond Tape Joint System and decorate with Gold Bond Sunflex, the one-hour wall paint. Or if you prefer, Gold Bond Gypsum Wallboard takes wallpaper beautifully. For further details, write Div. W, Dept. PS-5.**

Available at your local Gold Bond lumber and building materials dealer!

NATIONAL GYPSUM COMPANY
BUFFALO, 2, NEW YORK

Ancient History Dated By Atomic Calendar

A SINGLE ounce of wood from an Egyptian mummy's casket has told scientists when the long-dead Egyptian lived.

The answer—about 2800 B.C.—is based on a new method of dating archaeological discoveries by an "atomic calendar" through measurements of radioactivity.

Two University of Chicago scientists, Prof. Willard F. Libby and J. R. Arnold, tested samples of Douglas fir from Arizona, fragments of the wooden floor of an ancient Syrian palace, a piece of a giant California redwood felled three-quarters of a century ago, cedar of Lebanon from an Egyptian funeral boat, and wooden relics from Egyptian tombs. Then they checked their radioactivity results against methods currently used by archaeologists in dating objects—and found that their answers agreed with those obtained by the older methods.

A piece of cypress from the mummy's casket revealed it to be within a century or two of 4,750 years old. In most cases, exact dates to within a year cannot be obtained with either the new radioactivity method of dating or the older ones.

The new dating method depends upon Libby's previous discovery that the constant bombardment with cosmic rays turns some carbon atoms in every living thing—including the human body—into radioactive carbon 14. Carbon 14, scientists know, has a definite half life of almost 6,000 years. That is, within this period, the number of radioactive carbon atoms in any substance will decline by half.

The University of Chicago scientists, therefore, measure the age of any substance that once was alive by measuring the radioactivity of the carbon remaining in it. The less the radioactivity, the older the substance is.

Arnold and Libby developed a technique in which an ounce of wood was burned and gases reduced to pure carbon. Then they measured the radiation of the sample and estimated the age from the amount of radiation. In every case, their estimates agreed with the estimates made by other archeological means.

Their methods, however, have the advantages that they need not depend upon knowledge of past climate or upon associated objects whose age is already known. They can be successfully applied, the two

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Beware of the Danger Zone

THE MORE YOU DELAY - THE MORE YOU PAY

WARNING ZONE

Engine loses pep . . .

Needs a tune-up

Clean, adjust and re-time ignition. Clean fuel supply and carburetor screens. Adjust carburetor. Adjust tappets and fan belt. Check compression and vacuum readings for symptoms of ring wear.

DANGER ZONE 1

Engine begins to smoke . .

Needs new piston rings and minor engine repairs

Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves.

Tune engine.

These repairs are comparatively inexpensive and put the engine back in peak condition for thousands of economical miles. Delay puts the engine in Danger Zone 2.

DANGER ZONE 2

Engine pumps oil badly . . .

Needs new piston rings and major engine repairs

Replace piston rings. Replace piston pins. Adjust—probably replace—main bearings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves. Tune engine.

These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

DANGER ZONE 3

Destructive wear sets in . . .

Needs new piston rings and complete overhaul

Repairs cost three or four times as much as in Danger Zone 1.

Remove engine. Rebore cylinders. Replace pistons, pins, rings. Replace main bearings. Align rods, refit or replace rods, or replace rod bearings. Overhaul valve lifters, rocker arms. Replace timing chains or gears. Reseat, reface valves. Replace guides and springs. Replace camshaft bearings. Clean oil lines. Overhaul oil pump.

Clean, re-install and tune engine.

Piston rings should be replaced . . . *at the first sign of wear!*

When oil-pumping starts in your car, you're driving into the Danger Zone. Your piston rings should be replaced at once.

If you delay—until you're in the second or third Danger Zone—your repair bill will be two to four times as great.

If your car is in the Danger Zone now, ask your motor service man for Hastings Piston Rings. They *stop* oil-pumping, *check* cylinder wear and *restore* performance.

It's the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY • HASTINGS, MICHIGAN

Hastings Ltd., Toronto

HASTINGS

STEEL-VENT PISTON RINGS

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It's in most everybody's car after a winter of hard driving. If you want to duck some expensive repair bills—better get a new PUROLATOR Refill for your oil filter—quick!

When a filter is constantly freeing your oil from engine-wrecking abrasives, it soon gets choked up itself. So when you change your oil this Spring, start fresh with *a new filter refill*. Be sure you get a Purolator Refill. Filters more *completely*, hence saves more substantially on repair bills. Costs only $1.38 to $3.00, depending on make of car. Inserted in a few minutes.

P. S. If your car has no oil filter, a *complete* Purolator, *both* housing *and* refill, costs only $6.50 or a bit more, depending on make of car. Purolator Products, Inc., Rahway, N. J. and Toronto, Ontario, Canada.

Purolator

*MICRONIC OIL FILTER

*Reg. U. S. Pat. Off.

scientists say, to fragments of any substance that was once part of the body of a plant or animal.

So far, the scientists are convinced they can date, with reasonable accuracy, any sample of wood up to 4,600 years old. They hope to extend the method within the next year so that it will accurately measure relics 20,000 years old. Once this atomic calendar is thoroughly tested, it will give a new yardstick for calculating dates before man wrote history.

Relics left behind by ancient American Indians, fragments of early man, and objects from Peru, Europe, the Yukon, Mesopotamia, and Mexico will be tested. One special project will test samples of ancient pollen, and perhaps result in a "pollen clock" for dating ancient finds.

In this worldwide project, such relics of ancient civilization as charcoal, peat, cloth, flesh, and even antlers, teeth, and shells will be analyzed and dated. From the results, scientists hope to learn a lot more about who lived when. END

How Old Is Sandpaper?

IN HISTORICAL terms, sandpaper is a new product. The first known abrasive in sheet form was shark skin, used in the 12th Century. A hundred years later, the Chinese made a crude sandpaper by attaching powdered sea shells to parchment with natural gums. Later the Swiss applied a coating of ground glass to an animal hide.

Sandpaper as such became commercially available in England about 350 years ago. This consisted of glass and sand glued to a stiff paper. The abrasive grains often used today are not sand, but silicon carbide or aluminum oxide.

Tipped File Saves Fingers

FILING hand saws or doing other close jobs with a small file is often tough on the hand holding the pointed end of the file. If you have to do any amount of this work, you can ease the strain by making a rubber tip for the file. Cut out a small chunk of rubber (an old tire casing is a good source) and punch a hole through the center. Press the file tip into the center and shave or grind off the outer corners to form a ball-like grip. You'll be able to use a tipped file all day without developing finger cramp.—*Claude Sessions, Waynesville, Ill.*

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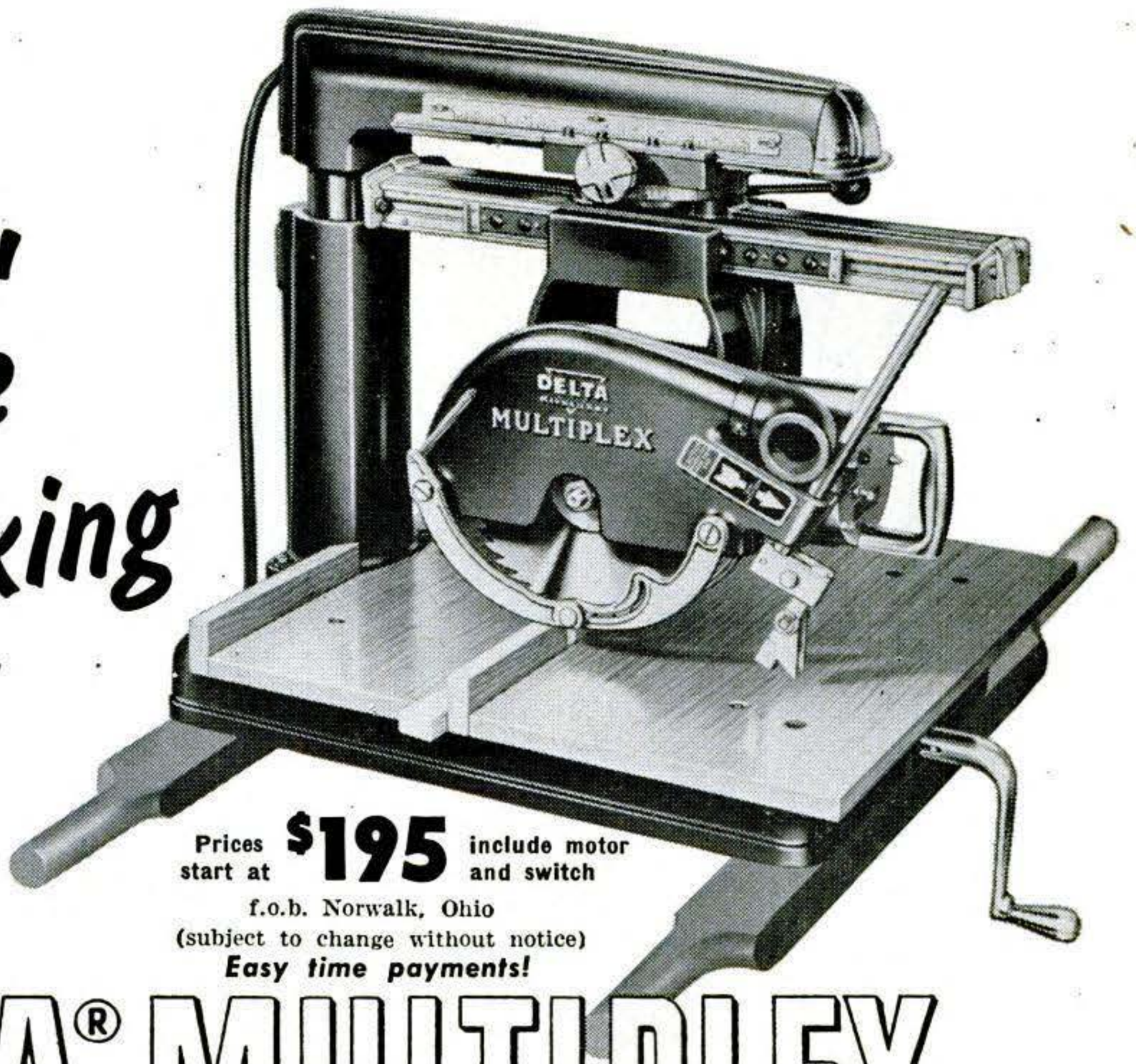
Low-cost, portable woodworking shop!



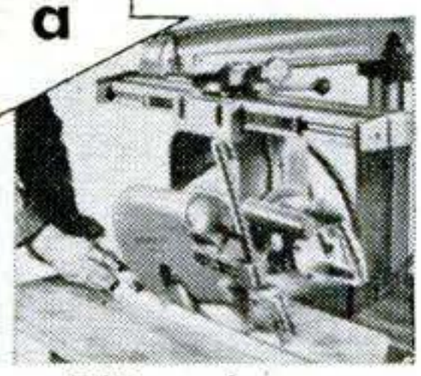
Prices start at **$195** include motor and switch

f.o.b. Norwalk, Ohio
(subject to change without notice)
Easy time payments!

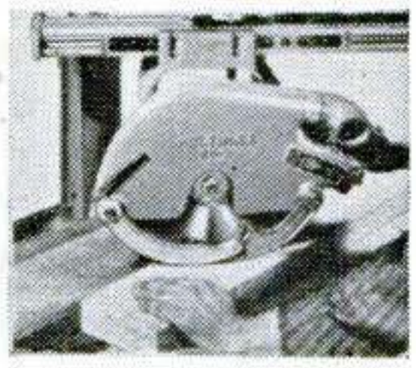
DELTA® MULTIPLEX

It's a

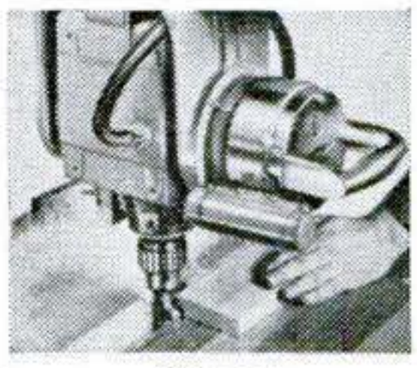
Rip saw


Tilting-arbor saw

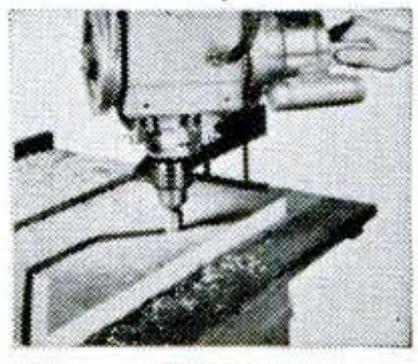
Variety saw


Miter saw

Tenoner


Shaper

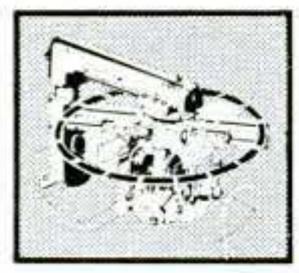
Dado machine


Router

Exclusive Double Radial Action gives you unequalled capacity and more flexibility!

Only 2 movements — instead of the outmoded 3:

Track swings for miter or rip



Motor tilts for bevel

Helps you meet rising labor costs and unskilled labor problems with these outstanding economies:

1. **Reduces your investment** — does the work of many tools.
2. **Speeds up materials handling** — you adjust the saw to the material, not the material to the saw.
3. **Reduces set-up time** — only 2 simple adjustments.
4. **Speeds Cutting**—you get production-line efficiency by gang-cutting.
5. **Steps up day's output** — reduces operator fatigue.
6. **Reduces waste** — accuracy helps eliminate scrap losses and extra finishing operations.
7. **Saves floor space** — you can use a Delta Multiplex flush against the wall.

Ask your Delta Multiplex dealer for a power demonstration — or see the new sound movie he can show you. Write for new catalog, "Unlimited Applications."

Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

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Be a Wizard with Wood

It's easy to do professional work at home! Here are magical products to aid you—reflecting the experience of United States Plywood Corporation and proven by years of satisfaction.

Strongest Wood Glue Ever Made

To make things or fix things, use Weldwood Glue for all wood-to-wood bonds. Makes joints stronger than the wood itself. Mixes easily with water. Stain-free, rot-proof . . . highly water-resistant! 15¢, 35¢, 65¢, 95¢ and larger sizes.

WELDWOOD
PLASTIC RESIN GLUE

A MUST for Finishing Fir Plywood

Tame that wild grain with FIRZITE. It tight-seals the pores . . . virtually prevents grain rise or checking . . . readies the surface satin-smooth for paint, stain or enamel. (For blond, pickled, wiped or tinted effects use White Firzite).

FIRZITE

Newer than Shellac or Varnish

Pints, Quarts, Gallons

For "natural wood" finishes on furniture or woodwork, there's nothing like Satinlac. Brings out the natural grain and color beauty of any plywood or solid wood. Avoids that "built-up" look, and will never turn yellow or darken with age. "Water-white", easy to brush or spray, dries ready for next coat in 2 or 3 hours.

SATINLAC

Ask for Weldwood Glue, Firzite and Satinlac at hardware, paint or lumber dealers.

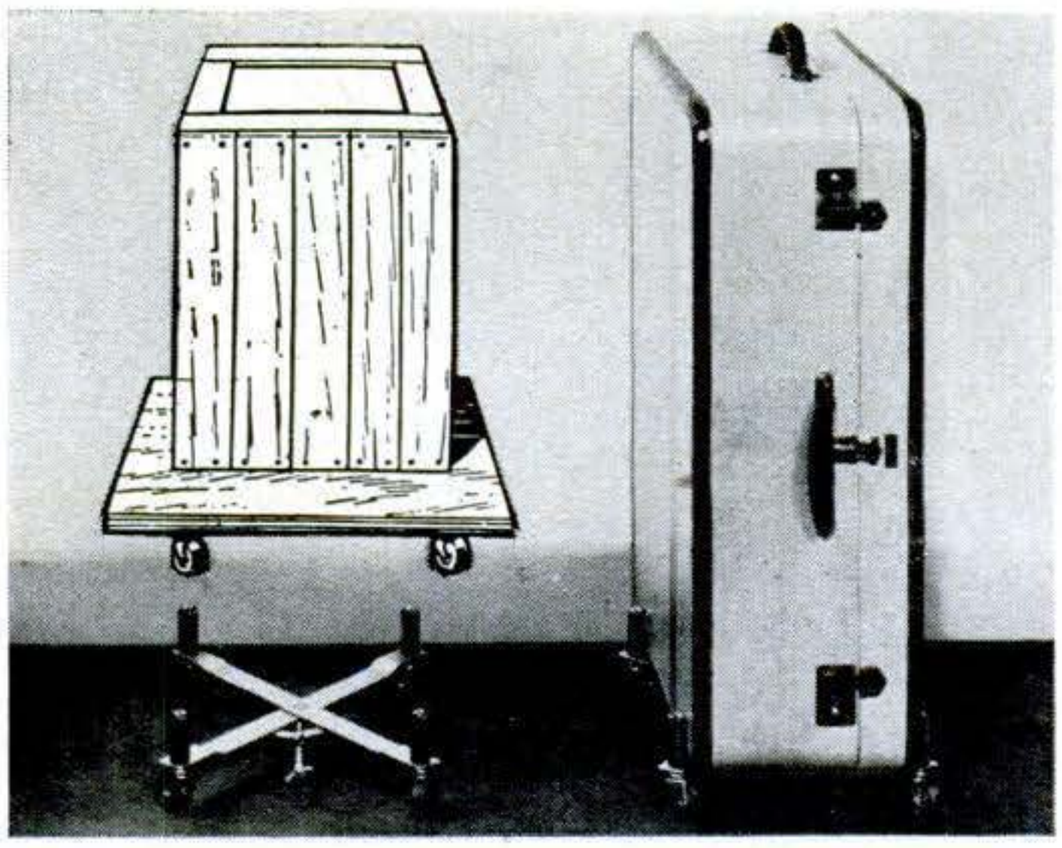
Send post card for interesting glue and finishing leaflets.

UNITED STATES PLYWOOD CORPORATION
Dept. 53, 55 West 44th St. • New York 18, N. Y.

Drill Runs Hedge Trimmer

ANOTHER attachment for a ¼″ electric drill is this rotary hedge cutter. It has a two-edged steel blade 7¼″ long mounted in a sheet-metal housing. The operator grasps

a handle on the housing with one hand and the drill with the other. Notches in the housing let twigs or weeds come within range of the whirling blade. The trimmer is priced at about $5 by the City Machine Co., Akron, Ohio.



Tipless Porter Lugs Luggage

MADE of heavy-gauge aluminum with rubber-covered, swivel wheels, the Tipless Porter® can be adjusted to fit any bag from 3″ to 15″ in either direction. A thumbscrew locks the four rubber-covered gripping posts. The gadget weighs less than 2 lb. and will handle up to 300 lb. For carrying crates, it can easily be converted into a dolly, as shown in the drawing, by placing a wood platform on it. Lewis & Conger, New York City, distribute the device for about $6.50.

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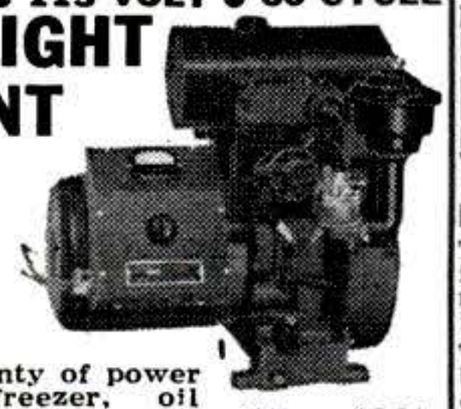
ALL ITEMS BRAND NEW • UNCONDITIONALLY GUARANTEED • SHOP BY MAIL AND SAVE!

EMERGENCY ELECTRICITY!

750 WATT • 115 VOLT • 60 CYCLE

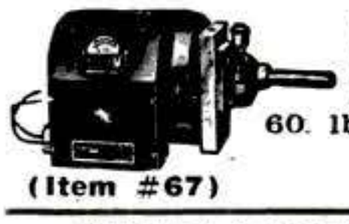
A. C. LIGHT PLANT



USE FOR: Home lighting, trailers, tourist cabins, hunting lodges, fire truck lighting, emergency standby units. Plenty of power for deep freezer, oil burners, incubator, radio or lights. **(Item #86)**

GENERATOR: Manufactured by Eicor, rated 750 Watts, 115 Volts A.C., 60 cycles at 1800 R.P.M. Complete with volt meter regulator. $249.00 value. These generators built to exacting Signal Corps specifications, are the answer to your lighting needs.

GASOLINE ENGINE: Briggs & Stratton, Model AP, 2¼ H.P., 1800 R.P.M. Completely radio shielded, full accessories including air cleaner, muffler, starting rope, killer button remote control wire. Shpg. Wt. 165 lbs. Complete unit, $249.00 Value. **F.O.B. Chicago** NOW ONLY **139.00**



(Item #67)

GENERATOR ONLY
Same as described above Shpg. wt. 60. lbs. **F.O.B. Chicago** **59.50**

ARC WELDER

STOP COSTLY REPAIR BILLS! WELD IT YOURSELF ... AND SAVE!

250 AMPS. MODEL 252. DESIGNED FOR MANY YEARS OF TROUBLE-FREE SERVICE. FOR ANY WELDING JOB, LIGHT OR HEAVY.

This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16" to ¼" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating—250 amps.: 0-30 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder.

(Item #65) **99.50** F.O.B. Chicago

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. **(Item #66)** F.O.B. Chicago **10.50**

GROBAN'S Guaranteed WAR SURPLUS BARGAINS

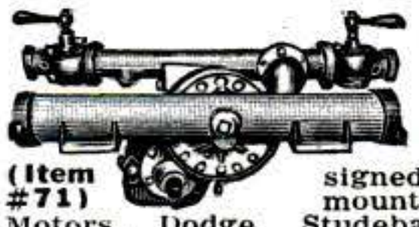
PNEUMATIC DRILLS

Used—Like New

ITEM #80—Ingersoll-Rand. Equipped with ¼" Jacobs key chuck. Overall dimen.: 6½" long, 5" high, 1½" thick, Wt. 3 lbs. **F.O.B. CHICAGO** .. **14.95**

ITEM #81—Chicago Pneumatic, Larger Size, Model A, equipped with ¼" Jacobs key chuck. Overall dimen.: 7½" long, 5" high, 2" thick. Wt. 4 lbs. **F.O.B. Chicago** **19.95**

WATEROUS PUMP



(Item #71)

Rated 500 gallons per minute at 120 P. S. I. This high efficiency pump is designed for front end mounting on General Motors, Dodge, Studebaker and Ford trucks and comes complete with gear box and power takeoff for easy mounting and attachment to crank shaft. Net weight of pump 500 lbs. Shipping weight 1200 lbs. ..... EACH **149.50** F.O.B. Ch'go

Vane Type—Manganese Bronze

INSECTICIDE PUMP

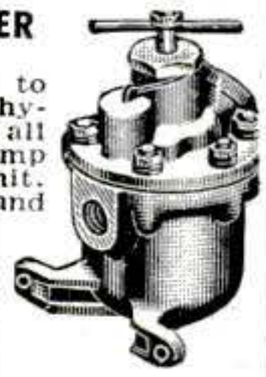
(Item #50)

For spraying DDT—2-4D, sulphur compounds, arsenic, oil solubles, etc. Pressures up to 200 PSI, delivering 5 gals. per min. at 1200 RPM. 8 gals. per min. at 1800 RPM. Will not rust, pit, foul or freeze up. Standard 1" pipe thread ports. Rotation—either direction 9" x 6" x 7". Shpg. wt. 10 lbs. Gov't. acquisition cost $42.00 ..... NOW **15.00**

FREE: Complete instructions and performance data with each pump.

PURALATOR OIL FILTER

PERMANENT TYPE



The perfect oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your pump or engine with this unit. Just turn the handle and the element is clean. Standard ⅜" inlet and outlet ports to accommodate 12 gallons per minute. Shipping weight 4 lbs. A $13.00 Value. NOW Postpaid ... **4.95** **(Item #70)**

Excellent Hydraulic VALUES!

Large supply of **new** labor-saving, economical hydraulic equipment in **many** types **and sizes** . . . including actuating cylinders, control **valves**, tanks, **pumps**, **fittings**, hose, and data **on** hydraulic **applications.**

Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, brakes, plastic dies, auto frame alignment, etc., etc.

LOGAN HEAVY DUTY

HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections. Overall dimen.: 12½" H x 8½" D x 8" W. Ship. wt. 17 lbs. Gov't Acquisition Cost over $100.00. An Excellent Buy.

(ITEM #37) F.O.B. Chicago **21.95**

LOGAN HEAVY DUTY

HYDRAULIC PUMP

. . . For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 5 H.P. Has ⅛" pipe thread ports. Rotate in either direction. Also use as hydraulic motor. ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 5½" W. A $105.00 value For Only ..... **22.50** **(ITEM #29)** F.O.B. Chicago

VICKERS HYDRAULIC TRANSMISSION

(ITEM #85) Model AA16801A

Ideal for lathe drive, miniature cars, power machinery, gearing, etc. Rated 2 HP maximum input at 3750 RPM. Output speed continuously variable from 0 to ⅓ of input speed in either direction. Self contained reservoir. All controls external. Even power at all speeds. Complete with two ½" shafts with flat for pulley attachment. **Shipping weight 20 lbs. Gov't acquisition cost $325.00. A TREMENDOUS VALUE AT . . .** **25.00** F.O.B. Chicago

FREE: NEW 44-PAGE CATALOG Chuck-full of sensational War Surplus "buys" and informative data on hydraulic applications.

HAND HYDRAULIC PUMPS

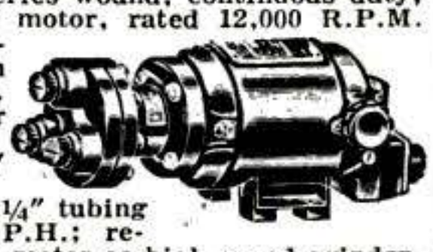
ITEM #11 Postpaid **8.95**

ITEM #83—Hand hydraulic pump with built-in transfer valve. Postpaid. **12.95**

SELF-PRIMING ELECTRIC PUMP

APPLICATIONS: Oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.

MOTOR MFD. BY BLACK & DECKER: Double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC.



PUMP MFD. BY WELDON TOOL CO. with standard ¼" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder. **OVERALL DIMENSIONS:** 7¾" long x 3¼" wide x 3¼" high. Approx. wt. 5 lbs. $51.00 value. **(Item #1)** **postpaid.** **12.95**

Hydraulic Cylinders-Air or Oil

ITEM #33C—Double action hydraulic cylinder. 1½" bore. 4½" stroke. Clevis mountings at both ends. Uses ¼" pipe fittings. **Postpaid** **8.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. in one second with Logan Pump. Wt. 4 lbs. A $45.00 value. **Postpaid** **10.95**

ITEM #16—Double acting cylinder, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only **postpaid** **12.95**

(Item #42)

ITEM #15—Double acting cylinder, 3" bore, 8½" stroke. All steel hydraulic cylinder. (will lift up to 7000 lbs. in 3 seconds with Logan Pump). Wt. 12 lbs. A $78.00 value. **postpaid** **19.50**

ITEM #31—Double acting cylinder, 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Wt. 15 lbs. A $92.00 value ..... **postpaid** **22.50**

ITEM #6—Double action. 3" bore. 23" stroke, hydraulic cylinder will lift 7070 lbs. in 5½ seconds using Logan Hydraulic Pump. Especially suited for farm and construction machinery. Clevis mounting for easy use. Wt. 22 lbs. A $145.00 value. **F.O.B. Chicago** **$27.50**

ITEM #42—Double action hydraulic cylinder. 4" bore. 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for ..... **F.O.B. Chicago** **32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.

ORDER DIRECT FROM AD—SEND PAYMENT OR PURCHASE ORDER TODAY—SATISFACTION GUARANTEED

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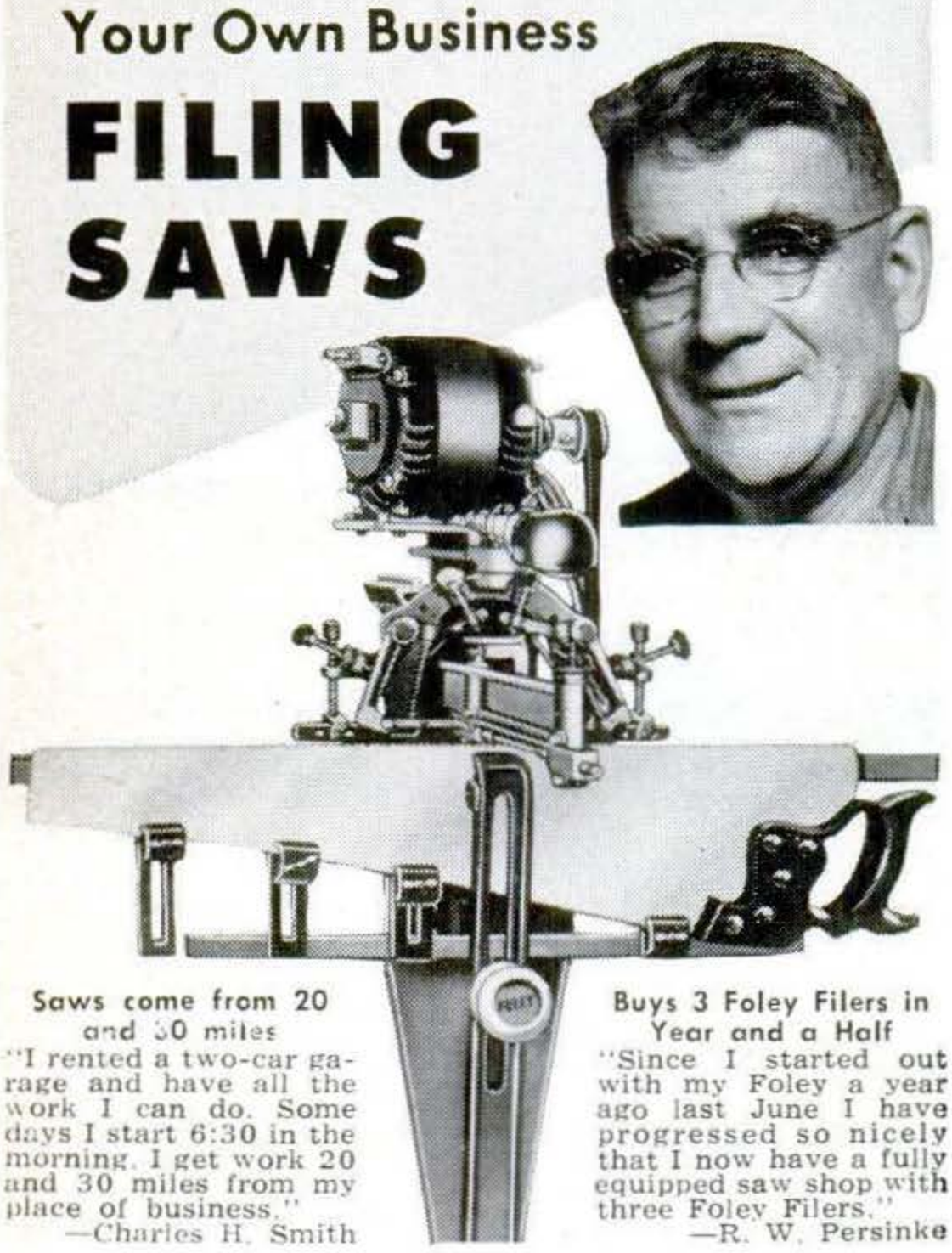
FREE PLAN

Tells How to Start Your Own Business

FILING SAWS



Saws come from 20 and 30 miles

"I rented a two-car garage and have all the work I can do. Some days I start 6:30 in the morning. I get work 20 and 30 miles from my place of business."
—Charles H. Smith

Buys 3 Foley Filers in Year and a Half

"Since I started out with my Foley a year ago last June I have progressed so nicely that I now have a fully equipped saw shop with three Foley Filers."
—R. W. Persinke

FOLEY FILED SAWS BRING NEW CUSTOMERS

Here is a steady repeat CASH business you can start in your own basement or garage in your spare time. Every saw you sharpen with the machine accuracy of the Foley Saw Filer is an ad that brings more customers. S. M. Hollingshead wrote to us: "I am doing very well with my Foley Filer, and I am glad I invested in your machinery. It is very satisfactory and works very well in the small community in which I live."

You can file all hand saws, also band and crosscut circular saws on the Foley Saw Filer. The adjustments are simple—there is no eyestrain—and you can start right away to turn out perfect cutting saws. "The first saw I sharpened with my Foley Saw Filer came out 100%. I think it is a marvel of perfection."—writes Clarence E. Parsons.

"INDEPENDENCE AFTER 40!" explains how you can get business from hardware stores, home owners, farmers, carpenters, schools, mills, factories, etc. Just think—with a modest investment, no overhead, no stock of goods to carry, you can start right in on a cash business that will help pay the rent, buy groceries, or a new car. Start now—you can get **Immediate Delivery** on a Foley Saw Filer. No salesmen will call.

Send For FREE BOOK

FOLEY MFG. CO., 519-0 Foley Bldg., Minneapolis 18, Minn.

Send me free book **"INDEPENDENCE AFTER 40!"**

Name . . . . . .

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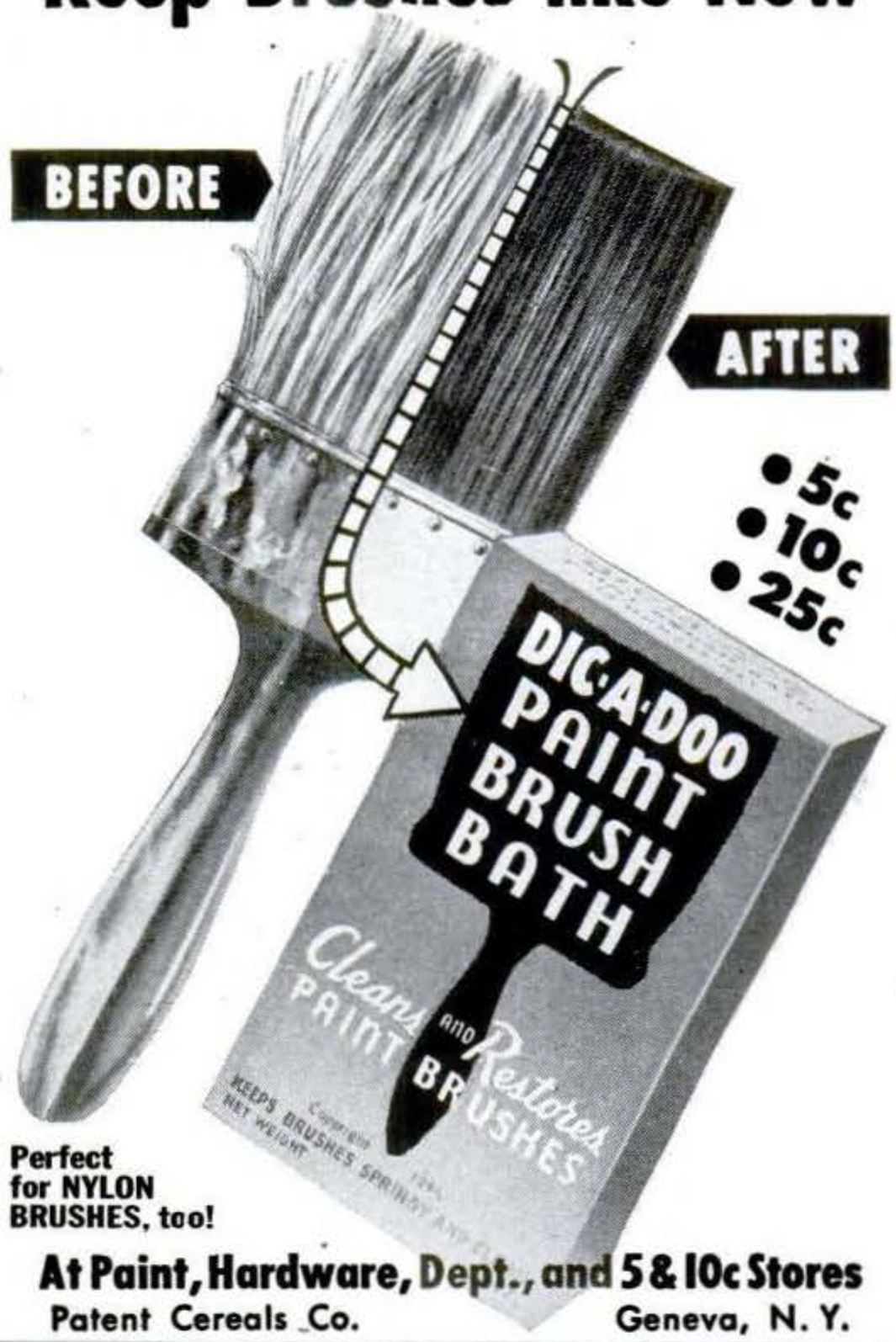
Keep Brushes like New



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Skate Sharpener Attachment Available

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Fits any man's size bike! Precision-built! America's finest bike motor. Ride one, and you'll buy one.

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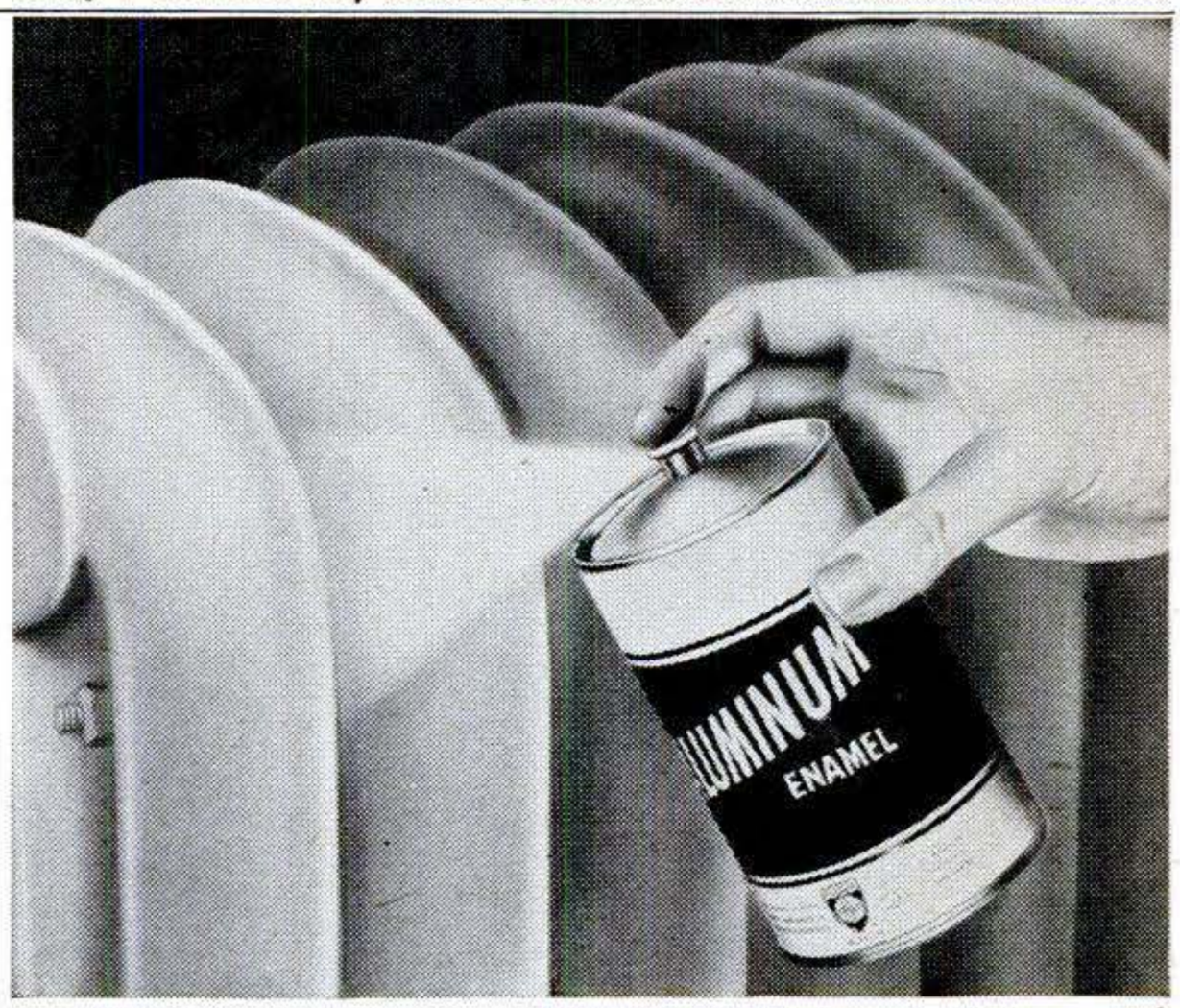
Give your radiators a fresh, clean look! Brighten them with easy-to-use Aluminum Enamel in handy spray cans available from any paint dealer. Ideal for all quick touch-up jobs on interior surfaces, for painting hard-to-get-at places. Aluminum Enamel is also available in standard containers. Use it for the hundreds of places around the home where you want good appearance, lasting protection with one-coat coverage. Remember, there is a difference in aluminum paints. For assurance of quality, buy the brand that displays the Alcoa symbol of quality. For detailed information on the right type for any job, write for book, "Paint It Bright". ALUMINUM COMPANY OF AMERICA, 1718E Gulf Building, Pittsburgh 19, Pa.



Look for this shield on aluminum paints made by many paint manufacturers using ALCOA PIGMENTS

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It's *more* than five rugged power tools in one compact unit. SHOPSMITH is a complete power workshop; saw, disc sander, horizontal and vertical drill press, lathe—each with *exclusive bonus features* that make SHOPSMITH far and away your best power tool buy!

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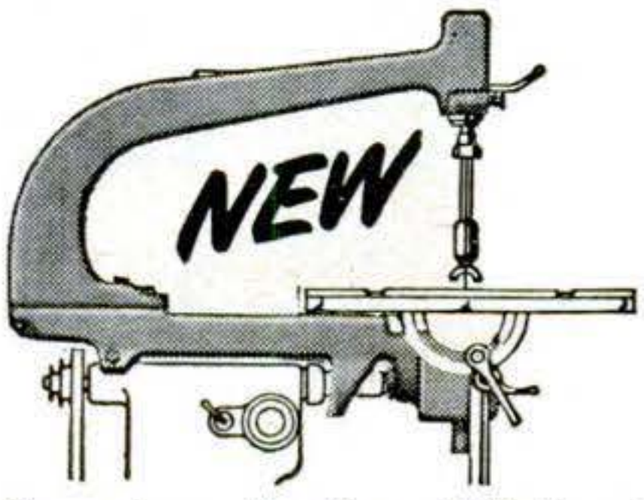
complete except for motor. With special, ½-hp., capacitor-type motor *(shown)*. . . $199.50

CONVENIENT TERMS

SHOP SMITH



JIGSAW for SHOPSMITH

The finest precision jigsaw you could own

Rugged construction. 18" throat. Large tilting table. Built-in blower. Attaches quickly with one bolt. Can be used also for saber sawing, machine filing. Complete attachment, $29.95.

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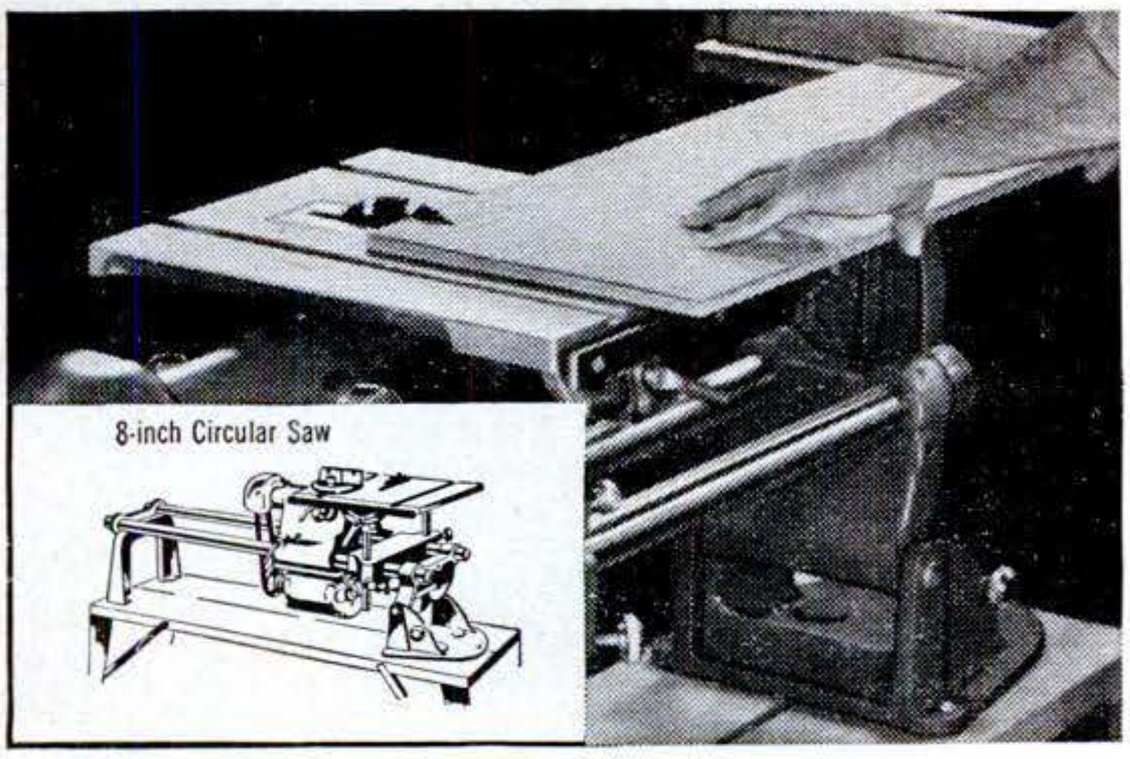
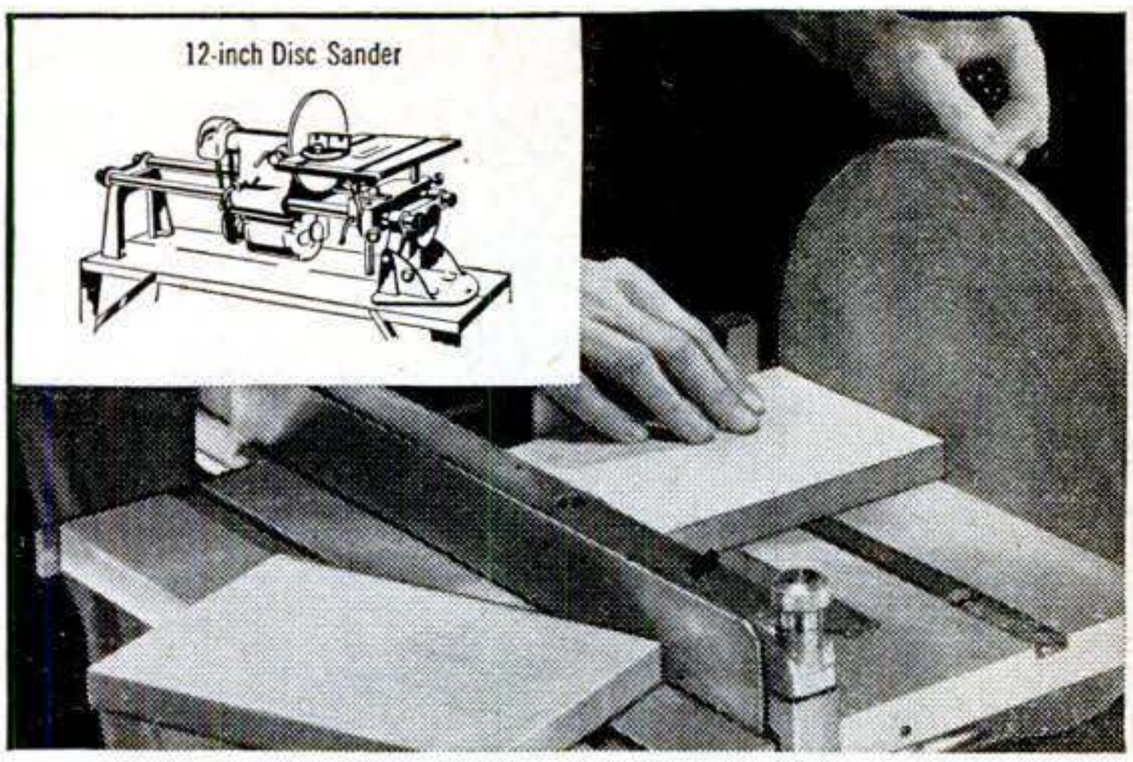
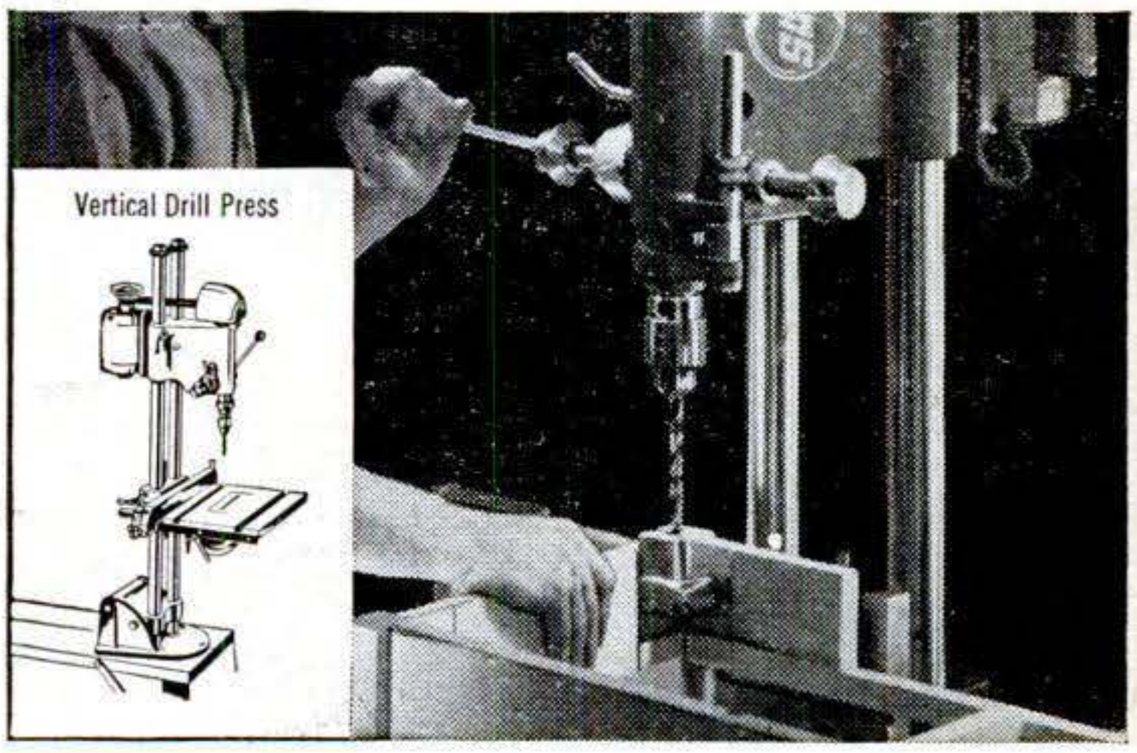


HAIRLINE SETTING. Unique micro-quill adjustment positions saw blade for extremely accurate width of cut. No more difficult fence settings. Saw has 48″ fence-to-blade capacity, large tilting table, precision tooled miter gauge, self-aligning rip-fence, table raiser. 2¼″ depth of cut.

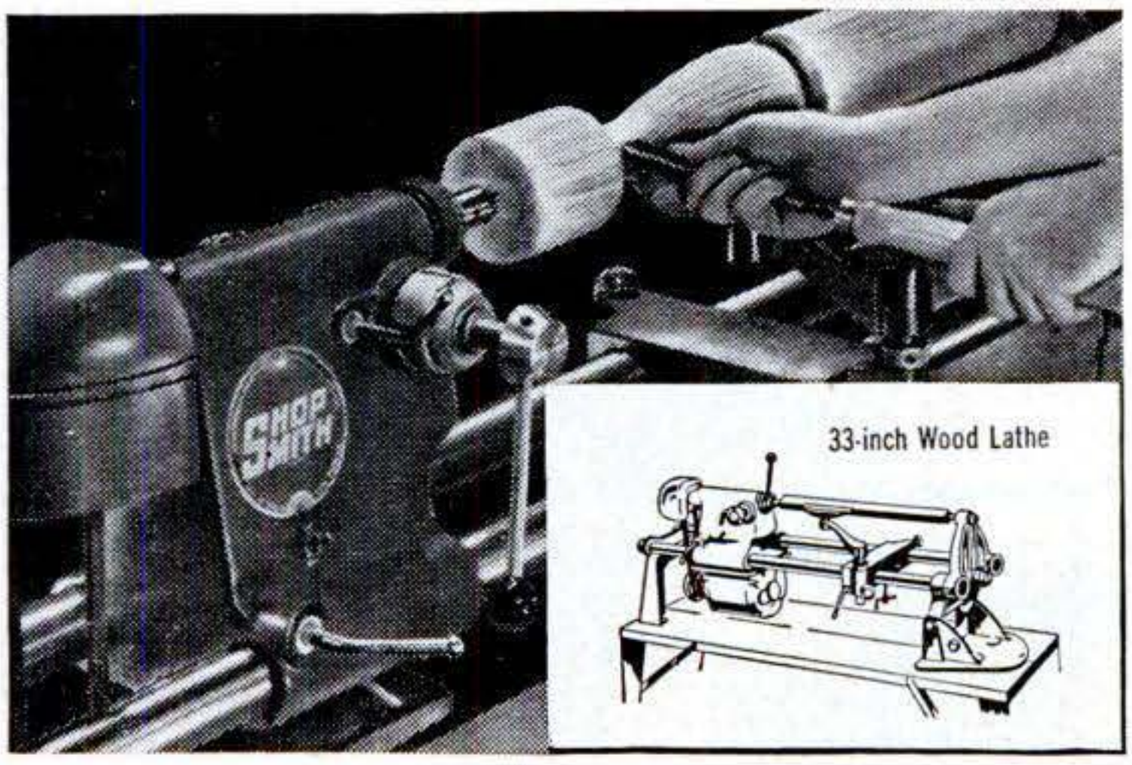


DUPLICATE SANDING. For making two or more pieces exactly the same length. Only SHOPSMITH has this feature plus 12″ precision balanced disc, 14½″ x 17″ tilting table, both miter gauge and fence. Disc feeds into work for maximum speed, accuracy and safety. Stop-nuts set feed depth.

PERFECT DOWELED JOINTS. No jigs required. Just lay work flat on table, feed drill from side. Dowel holes match perfectly. Especially handy for drilling or mortising large, heavy work. Speeds range from 875 to 3500 rpm. 4″ quill feed. Unlimited capacity. Adjustable depth scale.



LEFT-HANDED,TOO. Only drill press on the market with right- or left-hand feed lever. Drills to the center of 15″ circle. Maximum clearance table to chuck of 27″, floor to chuck, 55″. Jacobs key chuck takes drills up to ½″ diameter. 4″ quill feed. Miter gauge and rip fence form convenient jigs.



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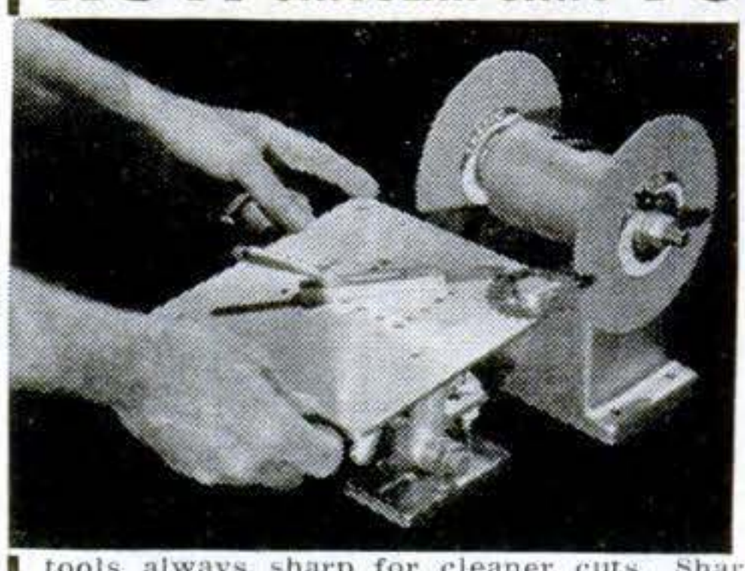
HOW TO SHARPEN CIRCULAR SAWS YOURSELF



Also Many Carbide Tip Tools And Cutters

This all-purpose, practical circular sharpening fixture is the ultimate in simplicity. Easiest, fastest sharpening method available. Precision built for precision sharpening.

Now, you can keep your saws and tools always sharp for cleaner cuts. Sharpening is a business opportunity, too.

Send check or money order . . . money-back guarantee . . . nothing to lose . . . shipped prepaid with complete operating instructions.

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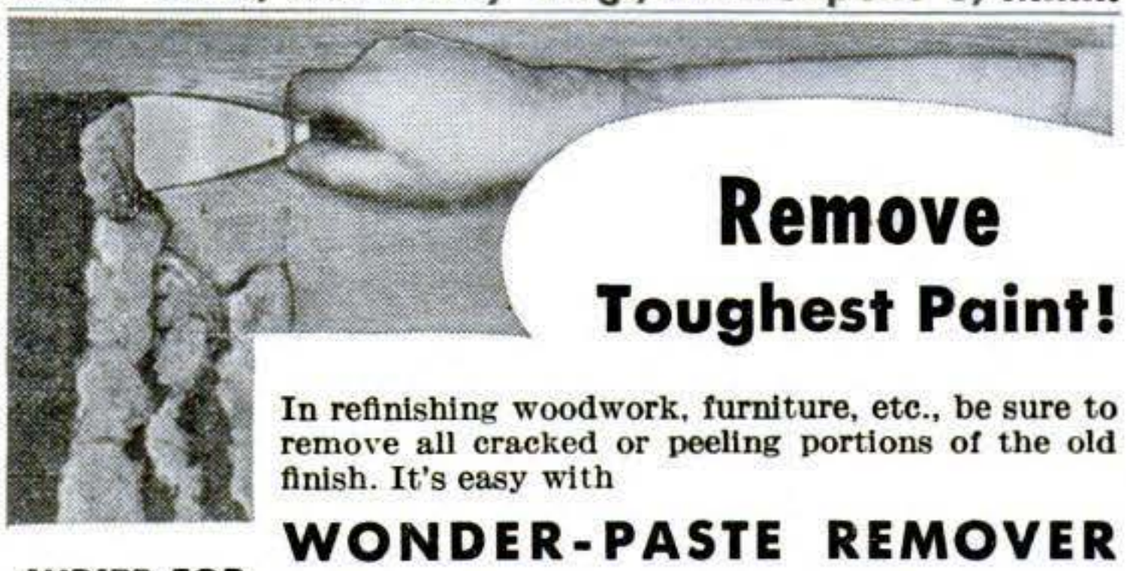

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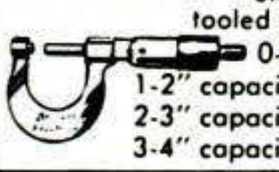

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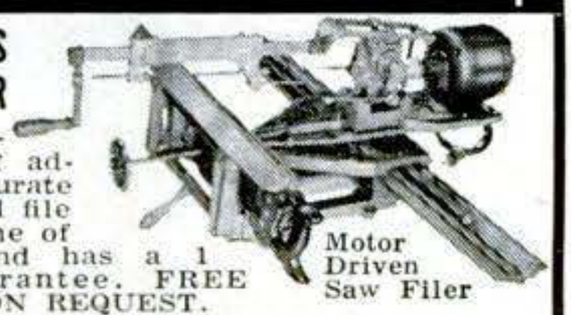

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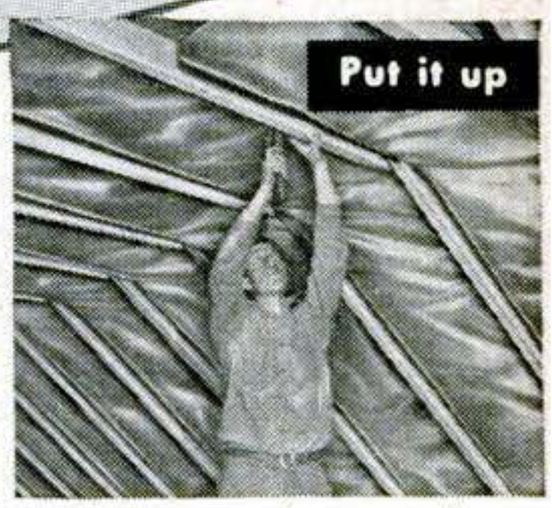

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Easy to tack or staple

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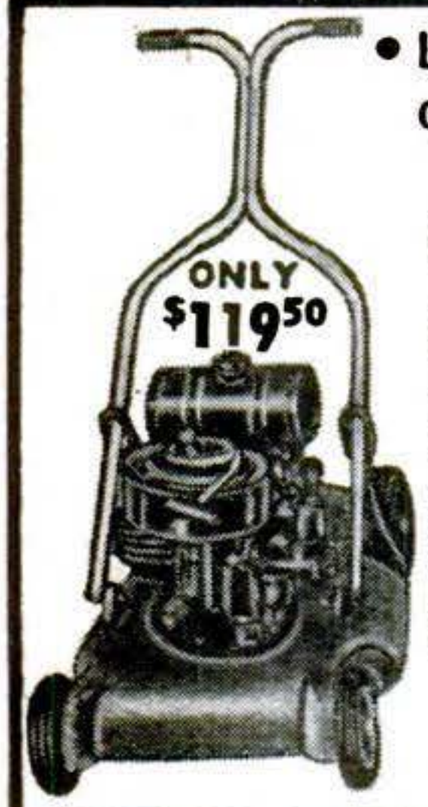

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As shown with 2½ H.P., 2 cycle McCullough engine.
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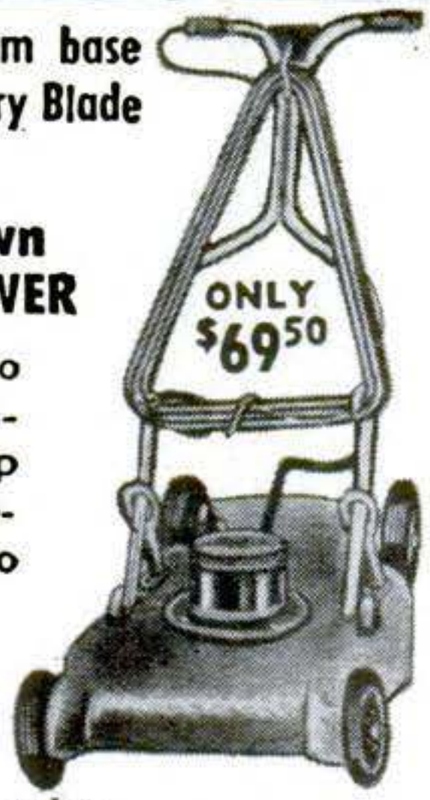
- Cast aluminum base with 18" Rotary Blade

Make Ur-Own POWER MOWER

Just add up to 2 hp gas engine or ½ hp electric motor Easy to install



- Ball-bearing rubber tired wheels

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Comes complete with ½ hp elec. motor and 75 ft of cord. Just plug it in.

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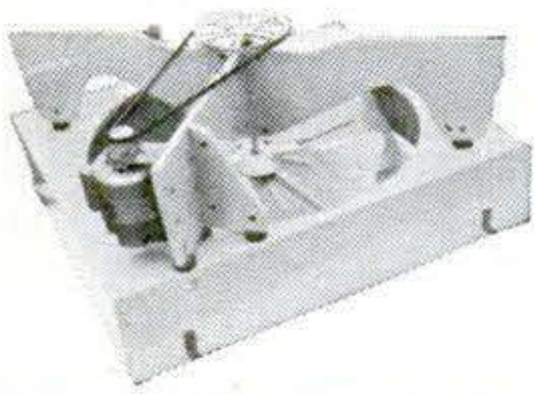

- Molded rubber cushions minimize vibration.
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- Efficient 36 inch Torrington Blade.
- Horizontal mounting makes installation easier.
- Rubber cushioned mounting brackets reduce noise.
- 9000 C.F.M. with ⅓ h.p. motor. Cools entire house.

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- Two heavy OILITE oilless bronze bearings
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- Pedestal mount for blade and pulley simplifies construction. Shipped ready to run.
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- Mounts out of way on outside of window.
- Belt driven with any 1/6 or ¼ h.p. motor.

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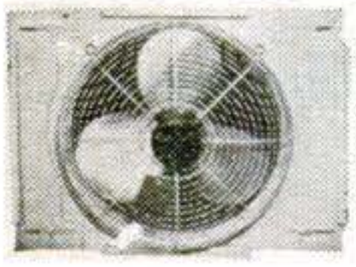

- Complete fan shipped ready-to-run. Cut out plywood panel and bolt to fan guard with four bolts.
- Direct drive nationally known Redman motor complete with cord and two-speed switch.
- Precision balanced Torrington blade.
- Sturdy wire guard, rubber mounted to minimize vibration.
- 3000 Cu. Ft. of air per Min.
- Build to fit any window 24 inches wide or over

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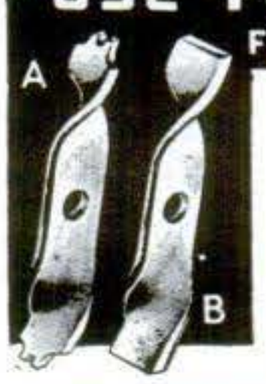
Finest low-cost tractor. Costs too little to do without. Engines burn gasoline or kerosene. Starter and lights available. Other larger Models to choose from. Over 4,000 in world-wide use. Time-proved and tested. At low cost they easily mow, plow, disc, harrow, plant, cultivate, etc. Sold only direct to user. Write for FREE details.

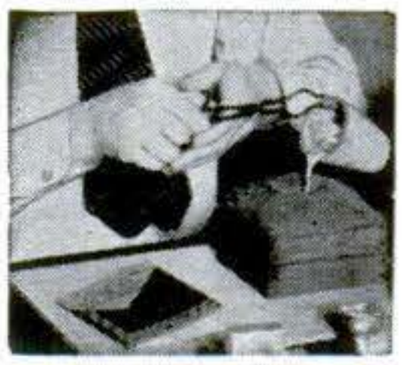
OTTAWA MFG. CO., 2-001 Garden St., Ottawa, Kansas

USE YOUR BENCH SAW
FOR JOINTING & CUTTING MOULDINGS



With our six inch tool steel cutters make mouldings, casings, drop-leaf tables, grooves beading and jointing. Moulding cutters, A 1 in. wide $1.75, 1½ in. $2.25. Jointing cutters, B 1 in. $1.75. 1½ in. $2.25. E 1 in. for drop-leaf tables. $1.75. E 1½ in. Makes ¾ in. cove & Quarter. $2.25. Postpaid. Guaranteed. State size hole. List & Folder free.

JOHN A. SANDSTROM
Rt. 2-P. Clearwater, Fla.



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Schools and Home Workshops

Make your own castings of aluminum, copper, bronze, silver. Foundry sets are available in three sizes including 2400 Deg. F. blast Furnaces, $22.50; $29.50; and $42.00. f.o.b. Kansas City. Free Circular.

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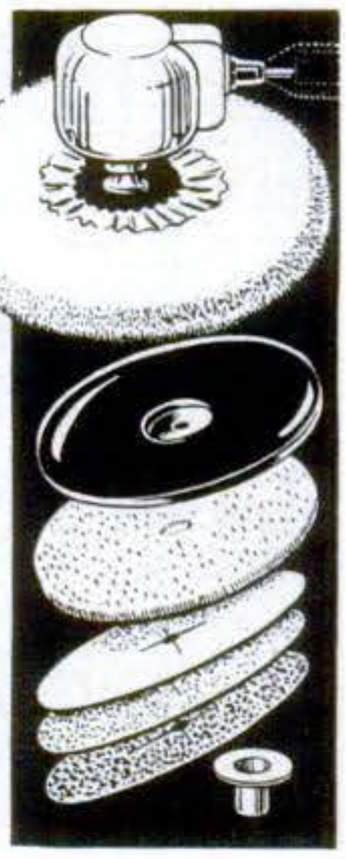
3 Speed Whirl-A-Way BUFFER AND SANDER KIT $7.95



Own this fine outfit. Adds many uses to your ¼" electric drill, both right angle and direct. Precision built. Polished speed-up and reducing gears in hand-grip housing, grease packed. Amazing Value. 3 SPEEDS . . . a right speed for every use. Includes: Sheepskin Bonnet, "Carpet Buffer", 3 types sanding discs, flexible rubber head . . . all equipment and supplies ready to use.

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Try "on the job" for 3 days at OUR RISK. Nothing finer for BOATS, CARS, HOME or WORKSHOP. Order today COD (or remit and we pay postage) GUARANTEED to please or full price refunded.

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For use as a shovel, hoe, pick, hammer or axe. Handiest tool you ever saw! Has sturdy 20" hardwood handle. 6"x9" pointed tempered steel blade with 2 cutting edges.

This Fine ALL-PURPOSE TOOL is a $1.95 VALUE! **79c**

New, but slightly weather-soiled — no damage to shovel at all.

NEW! CARRYALL

Waterproof Canvas

Fishing - Camping Bag

Dandy for FISHERMEN • BEACH HUNTERS • CAMPERS • BOY SCOUTS

EASILY A $1.95 VALUE!

Inside opens to 10" x4"x7". Has 2 outside pouches with snap fasteners. Cover fastens with buckle straps. Web carrying straps included.

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SWIM FLOATS

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SPORT BAGS

With Full Zipper Opens All Around

Perfect as a

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Attractive, Strong Easily Worth $2.50

Made of Fine Woven Khaki Canvas. Double Lined

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LOWEST PRICES IN THE COUNTRY

***NEW* CANVAS COVERS**

5 Ft.x7 Ft., $3.95 Value..**$2.79**

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NO-WIPE FLO-SPONGE

SCRUBS, WASHES & RINSES CAR IN 10 MINUTES

Clear water flows from supple sponge, leaves surface spotless—no streaking, no chamois needed. Can't scratch cars, windows, boats, floors etc. Fits into tight corners. Doubles as superior wet mop. Special, long-life, large DU PONT sponge replaceable at cost under 1c per car wash. Send payment with order to save C.O.D. charges. **Satisfaction Guaranteed**

Dealer inquiries invited

SPONG-IT *Manufacturing Co.* HOLYOKE, COLORADO DEPT. PS-1

$3.95 POST PAID

Wood Fasteners

DON'T split wood—Use amazing new "CHEVRONS"—A new type hardened steel fastener for wood joining (miter joints). Scientifically designed to draw wood together eliminating doweling, mortising, nailing. Just drive in with ordinary hammer—"Presto"—A firm joint! No wobble, no distortion. Narrow surface outline of fastener lends artistic appearance. Can easily be countersunk and concealed with wood fillers. Permits planing of wood on all sides. Can be used in hard wood where others fail. Handy, easy-to-use for mill workers, artisans and HOME CRAFTSMEN for making and repairing screens, doors, sash, frames, cabinets, chests, furniture, moulding, etc. Hurry—Order **now** from your dealer or send **Only** 75c (no stamps) for box of 100 3/8" depth, suitable for thickness of wood up to 1¼", or send $1.00 for our GIANT-Size box NOW! Money back if not delighted.

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100% Pure Pennsylvania
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TOUGH-FILM PENNZOIL® MOTOR OIL & LUBRICANTS AT BETTER DEALERS . . . COAST TO COAST

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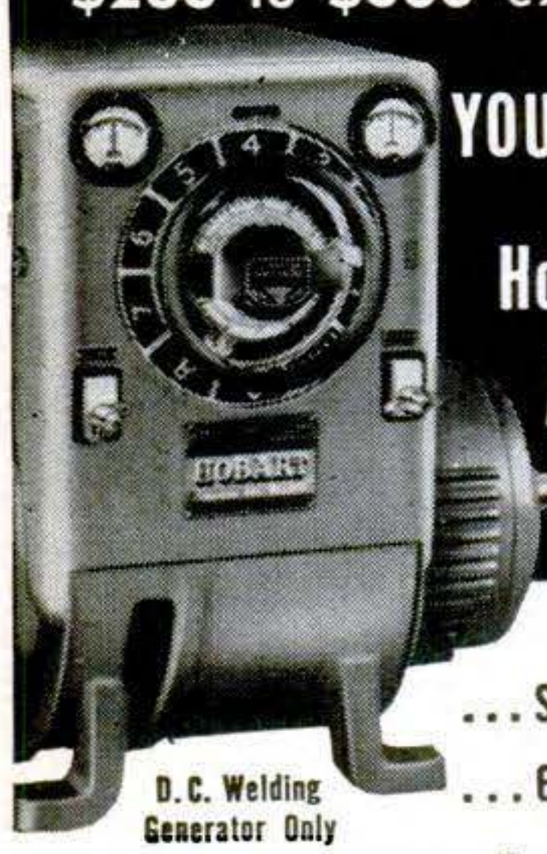
$200 to $300 extra profit monthly from YOUR OWN BUSINESS if you use Hobart "Simplified" ARC WELDING A.C. or D.C.



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...small payment starts you
...extra profits do the rest

For years, HOBART has been helping men like yourself get into the highly profitable and expanding field of arc welding.

NOW MORE OPPORTUNITY THAN EVER!

Builders, contractors, farmers, all kinds of businesses are aware of the advantages of arc welding. They need and want the services of weldors who have their own equipment and can do "on the job" welding.

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With a new HOBART Arc Welding Generator of the size and type you need you can rig up your own outfit in spare time. You'll save $$$$ and have a welder that will out-perform most factory built units.

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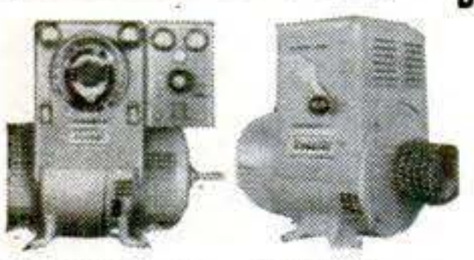
Ask about Hobart's liberal "PAY OUT OF EXTRA EARNINGS" PLAN — Send a card today!



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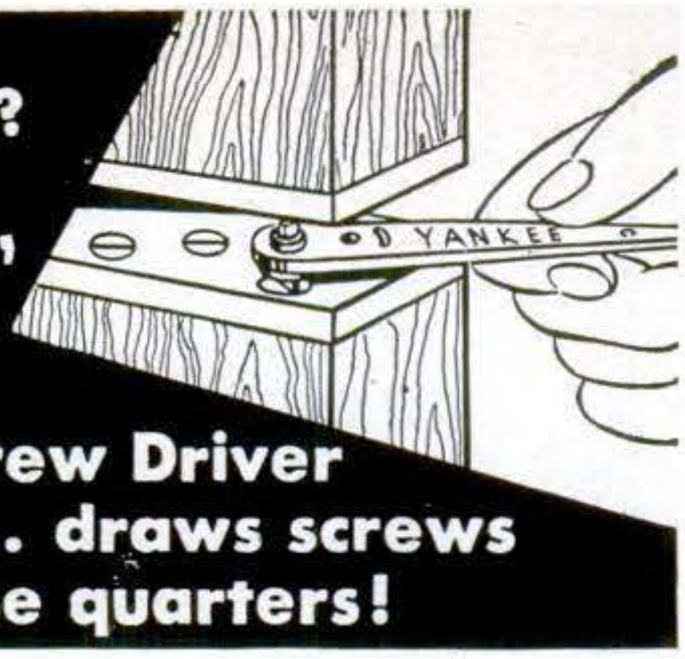
HOBART *"one of the world's largest builders of arc welders"*

In a tight spot? "YANKEE" Offset Screw Driver Drives . . . draws screws in close quarters!



Get 'em out or drive 'em easily in tight places with a "Yankee" Offset Ratchet Screw Driver! Lever action gives more power than a regular 8" screw driver. No. 3400 illustrated has ¼" and ⅜" blades for slotted screws; other models for Phillips Recessed Head Screws. At your Stanley dealer's. Write for free "Yankee" Tool Book.

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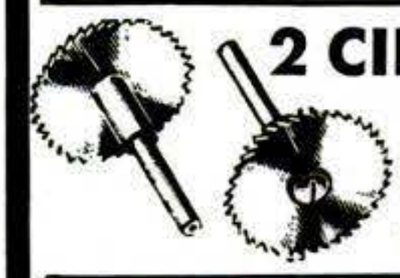
100 Pieces FOR ELECTRIC GRINDERS $1.00 Post Paid in U.S.A.

Grinding Wheels, Cut-off Wheels, Sanding Discs, Mounted Stones, Sharpening and Honing Stones, Rotary Cutting Burs, Abrasive Cartridges, and many other items. Rush check or Money Order.



2 CIRCULAR SAWS

ON 2 MANDRELS— ALL AT ONE LOW PRICE

1" diameter saws on ⅛" Mandrels. For cutting wood, plastic, or soft metals. Order at once! Send Check or Money Order for this big bargain.

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No experience needed. Two simple adjustments. Gets hollow-ground, cross-cut or combination saw blades true and sharp. Fits 6" to 12" blades with ½" to 13/16" centers. Includes file and complete instructions. $6.95 postpaid. (Check or money order) C.O.D.s postage extra. Guaranteed—Money back if not satisfied after 10 day trial. A money maker for fix-it shops. Soon pays for itself. Order today. Free folder.

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WITH *Infinitely VARIABLE SPEEDS, Clutch and INSTANT REVERSE*
OUTPUT TORQUE ADJUSTMENT UP TO 180 inch POUNDS

This positive displacement Hydraulic Torque Converter is the ideal fluid drive with thousands of uses..Output Speeds Infinite .0 to 550 R.P.M...in either direction..Change Speeds WHILE RUNNING..Control and Transmit your power this SMOOTH Oil-Way..Will handle ¼ H.P. to 1½ H.P. Motor. Industrial or Home & Farm Use..Cost Government $300. High Quality Precision Workmanship. Buy this unit to get the most for your money. Case measures 7½" long 7" high 6½" wide. Input & Output Shafts ⅝" dia. Beautiful Red Crackle Finish Case.

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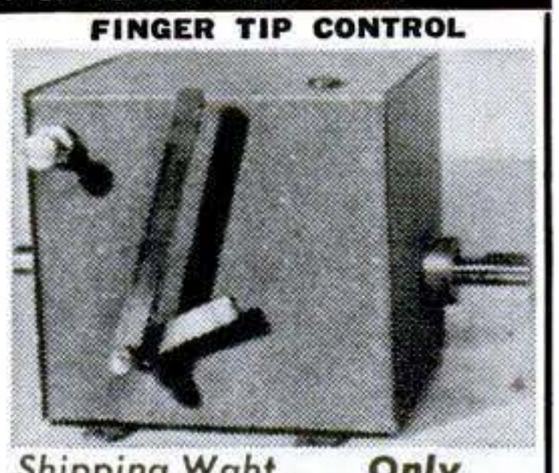

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Only **$54.50** PREPAID
2 quarts oil included FREE

If C.O.D. is requested a 10% Deposit must accompany order and we ship F.O.B. Chicago.

1½"-8 thread Lathe Chuck Adapter, $3 extra

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MEET THE NEW BULL SAW!

Convert your electric drill into a powerful, portable saw for only $9.95

Your electric drill becomes a portable saw with power to spare when you attach the new Bull Saw! It's sturdy, rigid—yet light enough for *one-hand* operation. New visual guide lets you see where you're going; new extra wide shoe plate keeps saw blade on the straight-and-narrow. One-piece safety guard of polished aluminum . . . blade of high-carbon steel . . . double bearings for long life. Fits rigidly on any 1/4" electric drill. Depth of cut: 1 1/8". Complete, ready to use in drill **$9.95**
(When ordering, ask for Model BS-C)

IF YOU ALREADY OWN A BULL BUFFER

you can make your own Bull Saw for only **$7.50**! Here's how: order the saw housing (photo 13) and attach it to the anglehead of your Bull Buffer, following the simple directions we send you. That's all—it only takes 30 seconds to change your Bull Buffer into a powerful, portable saw! The housing you need comes complete, only . . . **$7.50**
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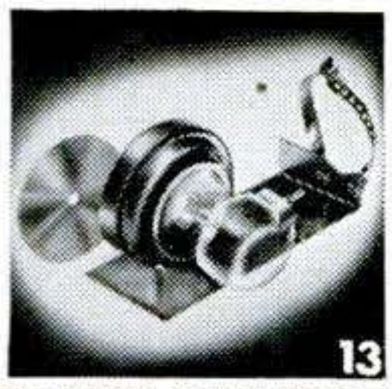

COMPLETE POLISH-SAND-'N-SAW KIT

Includes (photo 2) Bull Buffer*, famous right-angle polisher-sander complete with rubber pad, sheepskin bonnet, 2 sanding discs and (photo 13) Saw Housing that fits on Bull Buffer angle head to give you a powerful Bull Saw. A $19.90 value, yours for only **$14.95**
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**Bull Buffer only, with sheepskin bonnet and 2 sanding discs, $9.95.*

At your dealer, or send cash, check or M.O. for prepaid shipment

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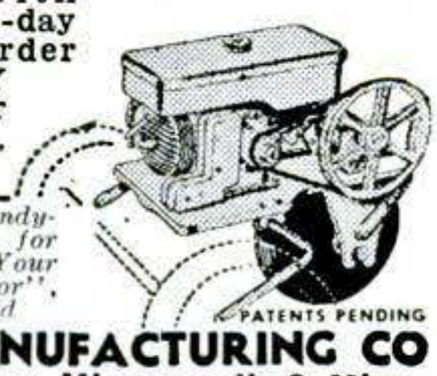
IT'S EASY TO CONVERT YOUR MOWER TO A POWER MOWER

Equip your hand mower with a LeJay MidgeTractor. It snaps on in a jiffy. It's ready to go! Backs up and maneuvers amazingly easy. Costs far less than regular power mowers. Unheard of low price—Only $54.95 complete. Or, $29.70 less engine . . . use your own engine (any make 3/4-1 1/2 HP or 1/3 HP electric motor). Free literature.

ONLY $29.70

Guaranteed with money back 5-day trial offer. Order your LEJAY MidgeTractor from this ad, do it today.



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PATENTS PENDING

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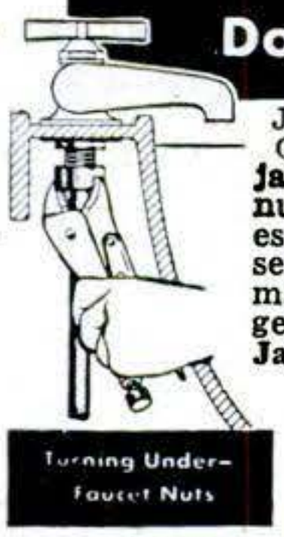
Can any other tool do this?

Genuine VISE-GRIP WRENCH Does it EASILY!



Just lock VISE-GRIP's Ton-Grip **jaws to** stubborn **nuts, even** in closest quarters, and see how easily they turn! Does difficult jobs like magic! Does jobs no other tool can do! Only the genuine VISE-GRIP has these features. **Involute Jaw Curve** holds all shapes, with remarkable ease. **Knurled Jaw Tips** hold to the very tip. **Thin Nose. Super Wire-Cutter.** Specially hardened alloy steels, nickel plated finish. With cutter—No. 7W, 7", $2.25; No. 10W, 10", $2.50. Without cutter—No. 7C, 7", $1.85; No. 10C, 10", $2.25. If not at your dealer's, order direct.

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...and more with the *Super-Value* CASCO *Electr-o-matic* POWER TOOL-KIT

Super-speed, precision-engineered — the most practical power workshop you can own! Pays for itself a hundred times over when put to work on dollar-saving repair jobs throughout the home. Makes decorative objects, too! No home repair or hobby job too difficult. Complete with 50 accessories, lifetime plastic chest and 36-page project book.

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ONLY $1.50

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SHAW "DU-ALL" and "PEPPY PAL" GARDEN TRACTORS

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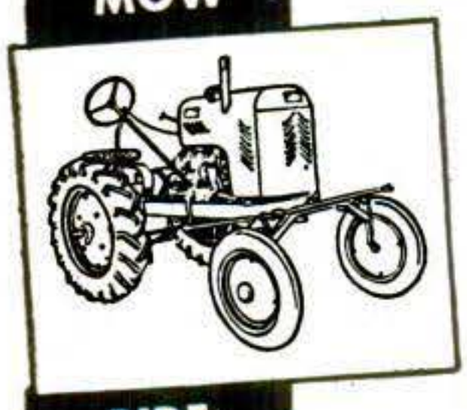

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These sturdy walking and riding tractors ideal for dozens of uses around the farm, orchard, garden, golf course, estate and poultry farm.

DO DOZENS OF JOBS
Shaw Du-All or Peppy-Pal tractors do many jobs quickly and easily. Plow, cultivate, harrow, mow, disk, bulldoze, spray, grind, haul and saw wood. New uses discovered every day.

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Sturdy, extra-strength construction means low upkeep, long life. Patented tool control allows quick shift for crooked rows. Attachments easy to change with new "Jiffy Hitch."

CHEAP TO OPERATE
Operates on few cents an hour. Soon pays for itself in time and labor-saving plus low initial and operating costs.

NEW LOW PRICES
Buy direct or through your dealer! Almost anyone who has a garden can afford a Shaw Du-All or Peppy-Pal. Full year's guarantee.

RIDING TRACTORS
Four models, from 5 to 12½ H.P., 58 in. wheelbase, 36 in. wide, 24 in. plant clearance. Hand or electric starter. Improved steering device, brakes enclosed in differential housing shaft. Standard hitch for trailers and wagons. Plow, harrow, cultivator, cutter bar, snow plow, bulldozer available.

PROMPT SHIPMENT
No waiting—order now for immediate delivery.

RW-2

SHAW MFG. CO.

FREE: Illustrated folders giving complete details and price lists. Write today:
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Yes, here it is—that extra length you've always wanted...120 inches of accurate, more useful measuring ease. Jet black markings on a wear-resistant, acid-resistant snow white blade.

Carlson quality throughout with famous 10-second blade change economy and the new convenient *swing-tip*...a *real* value at YOUR HARDWARE DEALER. Just be sure it's the *White Chief* by *Carlson*.

P.S. And don't forget to get an extra blade to keep on hand as a "spare."

Blade produced under Pat. No. 2089209

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CARLSON & SULLIVAN, INC.
MONROVIA, CALIFORNIA
CARLSON

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NEW RAPID SAW FILER
Opens the door to extra income. Easy to operate. Fast efficient BeMaCo power filer for hand saws. Priced right! Does a beautiful job. Operator has complete control.

BEMACO AUTOMATIC SAW SET—
Uniformly sets 400 teeth per minute. Perfect hammer and anvil action. No tooth breakage.

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WE CAN SUPPLY COMPLETELY RECONDITIONED JEEPS WITH NEW WELDING UNITS $845

Regular $795 G-E welding unit mounted on reconditioned jeep. Would cost over $1900 for new jeep and this unit. This bargain will never be equalled!

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200 Amp General Electric

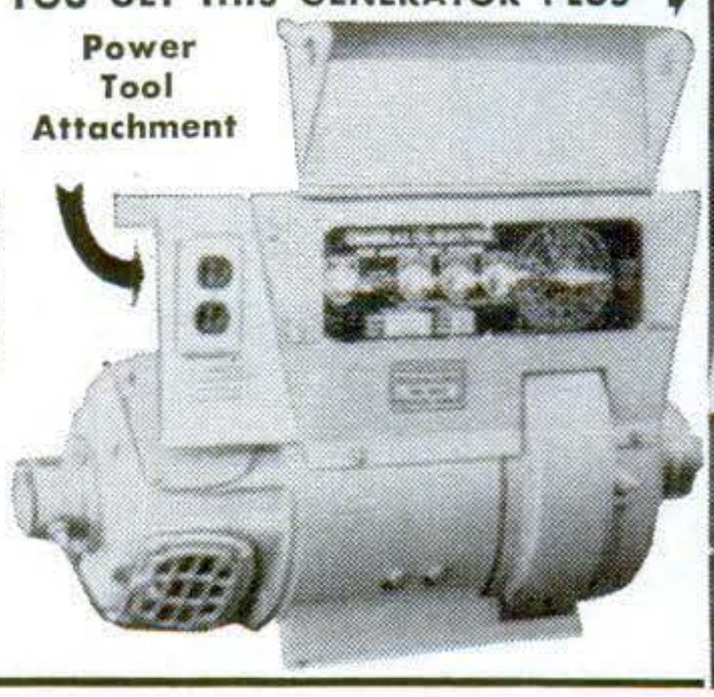
Mobile Arc Welding Unit

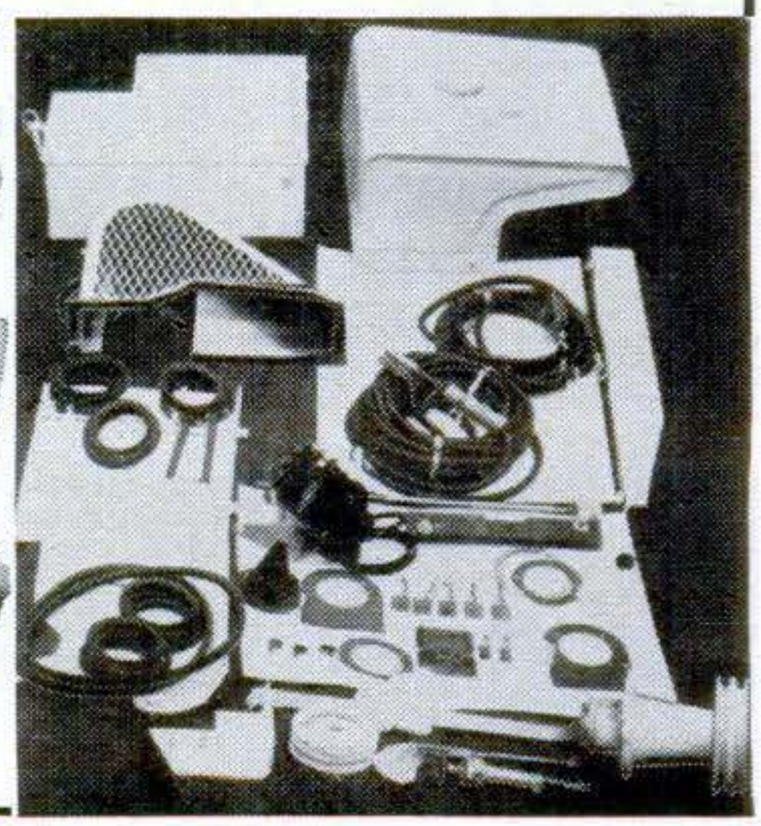
Use your jeep as a mobile arc welder. Complete arc welding generator kits, 68 component parts including 200 amp. welding generator. Comes with spare parts for generator, cable, electrode holder, ground clamps. Fits any jeep, military or civilian.

$345 68 COMPONENT PARTS COMPLETE—SHIPPING WT. COMPLETE 675 LBS.

YOU GET THIS GENERATOR PLUS

Power Tool Attachment





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Shipping weight complete 675 lbs. Capable of welding 1/4" rod continuously. AC-DC power tool outlet. Maximum amperage—285. Complete—ready for use—nothing else to buy. Engineered for civilian or military jeep, adaptable to farm tractor, any gasoline engine. Price is F.O.B. Cleveland.

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Presenting A Powerful Companion To The Famous Dremel Model "A" Sander

Dremel's new Model 2000 gives you the finest finish sanding money can buy. For polishing too, this new machine is a superb performer. And now it's yours at the remarkably low price of only $24.50.

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ONLY $24.50 WITH STEEL CARRYING CASE AND COMPLETE ACCESSORIES

14,400 Sanding Strokes Per Minute

PRICE INCLUDES STURDY CARRYING CASE

Perfect portability of Sander, cord, abrasives, and polishing pads in this sturdy, 3-shelf metal storage case. Price also includes 25 assorted sheets Garnet Paper and a high-grade sheepskin polishing pad.

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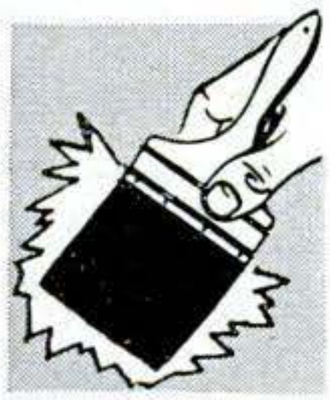

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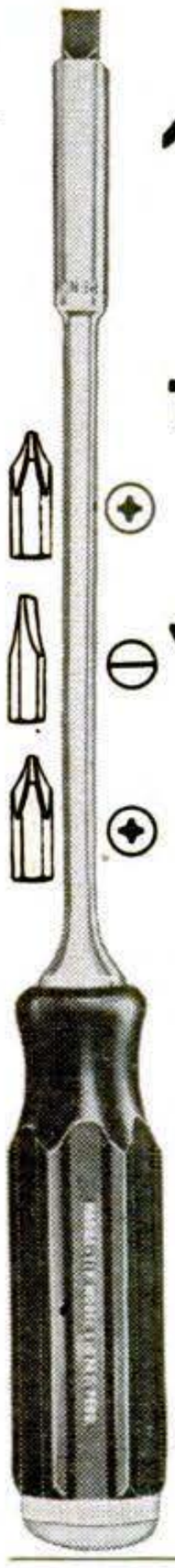

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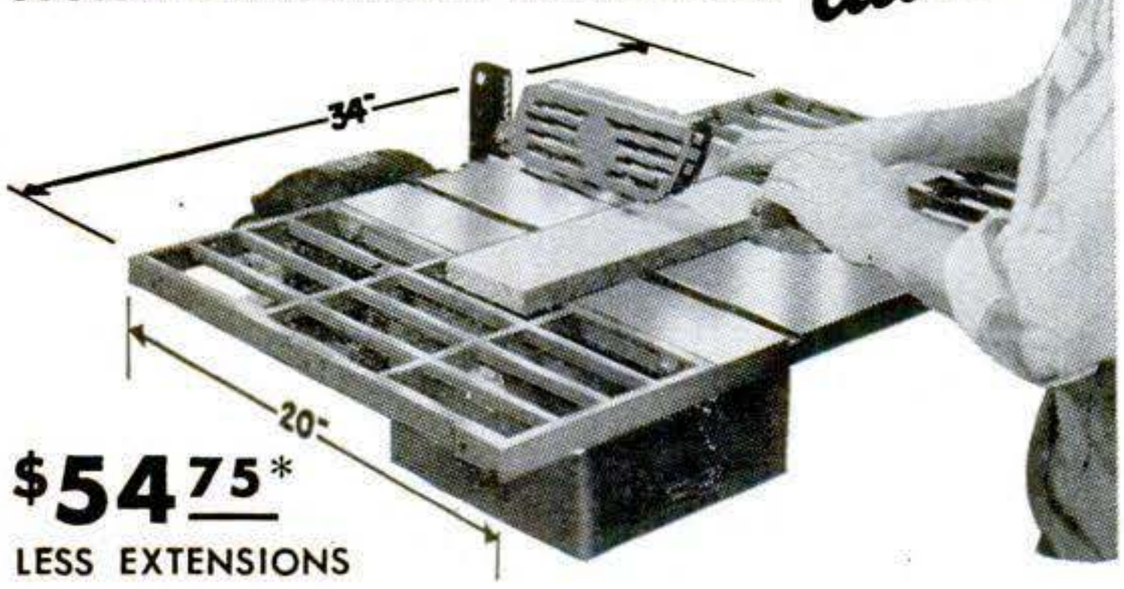

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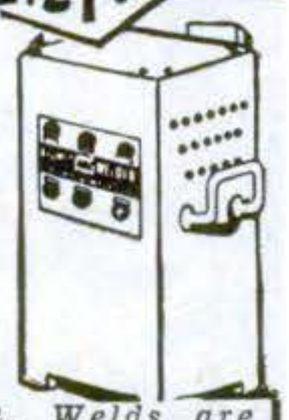

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Special Ferret Tools

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A shockproof, plastic handle, 5⅛" long that is ideal for electric work. Makes your Ferret Set more useful.

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Converts any combination of Ferret handle, extension and socket into a reverse action ratcheting tool.

$27.65

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This set is way over par in performance . . . the tools are strong and easily adaptable to a variety of jobs . . . they squeeze into tight places and get hard-to-reach nuts that defy the ordinary type wrench. INCLUDED IN THE SET: 1/4" and 5/16" single broached sockets; 11 double broached sockets from 3/8" to 7/8"; a speedier wrench, sliding tee, 8" reversible ratchet, nut spinner and universal joint, plus a 3", 6" and 12" extension. All complete in a metal box.

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☐ Please send illustrated brochure describing 109 individual Ferret units.

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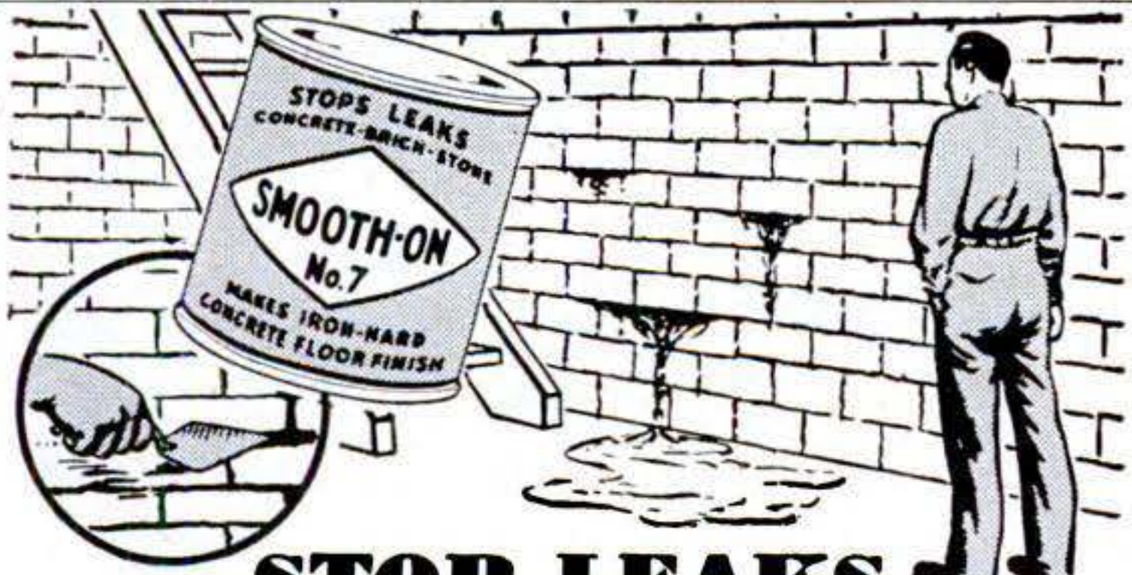

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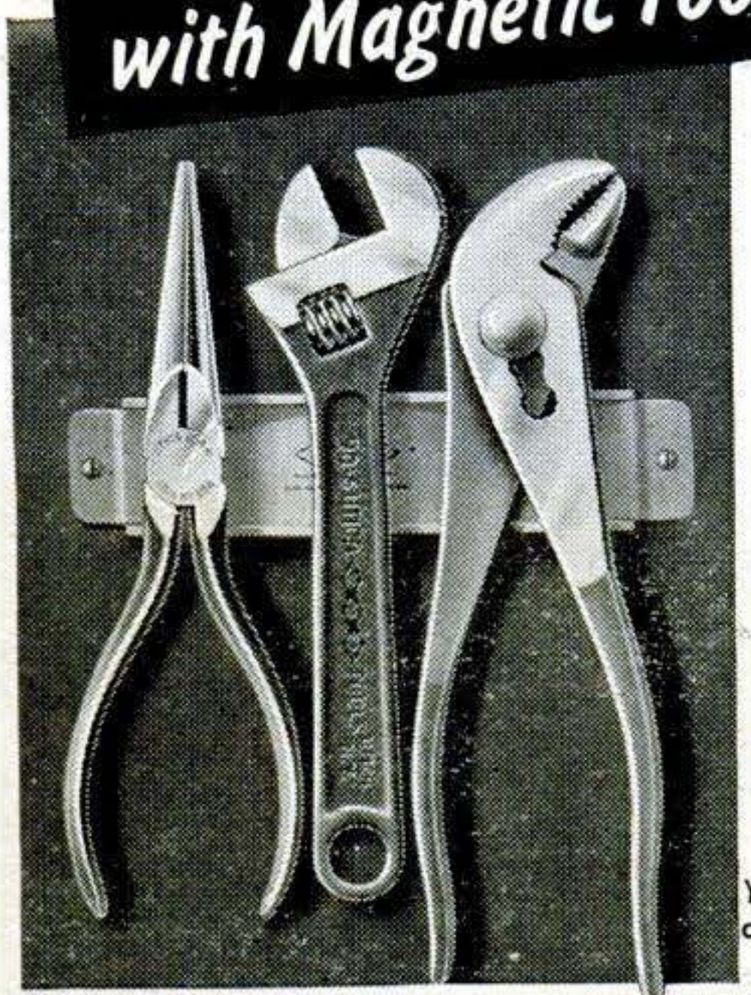

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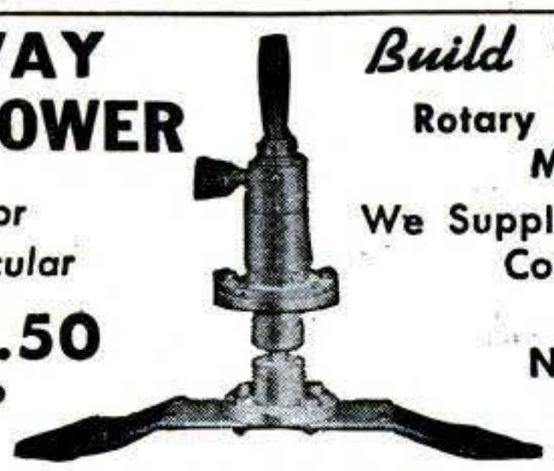

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We Supply Cutting Unit Complete.

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Do expert saw filing at home. Precision filing easy without experience. Two simple adjustments. Keeps any hand saw extra sharp and true-cutting. Complete with file. Money back guarantee. Cash with order, prepaid. (COD postage extra.) Order today.

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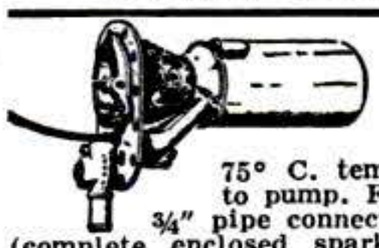

POWER FLUID PUMP

Capacity 3 GPM at 30 PSI. Delco 1/6 H.P. Completely enclosed and waterproofed. Ball bearing. 8000 RPM. 24 volt DC-AC electric motor. 75° C. temperature rise—continuous duty. Direct connected to pump. Filter intake system. Pump has swivel neck with ¾" pipe connection. Ideal for sump pump or inflammable fluids (complete enclosed sparkproof motor). Original cost over $100.00. Perfect condition, ready to run..... **$9.25**

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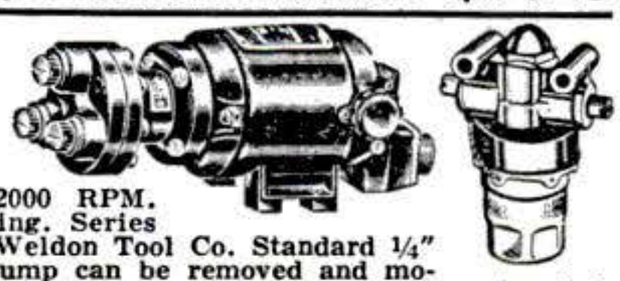

Brand new with Skinner clean-out type filter. ⅛" pipe connections. 1/30th H.P. Black and Decker electric motor. 12000 RPM. 24-32 volt DC Double ball bearing. Series wound. Pump manufactured by Weldon Tool Co. Standard ¼" pipe connection. Rated 2-GP. Pump can be removed and motor used as grinder. Applications—oil burners, fuel pump, tool post grinder, coolant pump, lub pump. Filter can be used with pump or any other filtering applications, such as hydraulic lines or auto gas lines. Electric pump and filter priced at only..... **$8.95**

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SET 2 8 different size Hand Reamers up to ½". Brand new. Priced at only..... **$3.75**

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SET 9 10 different size High Speed Morse Taper Shank Drills. No. 3, 4 and 5 taper. From ⅝" to 1⅜". New and slightly used surplus..... **$24.95**

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1" $1.25	1-9/32" ... 1.79	1⅜" $2.25
1-1/16" ..$1.49	1-5/16" ..$2.00	1-7/16" ..$2.35
1⅛" $1.59	1-11/32" .$2.15	1-15/32" .$2.50
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2⅜" $6.50	2⅝".....$8.70	3½" $10.50
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SIDE MILLING CUTTERS

Dia.	Width	Arbor Hole	Price Ea.
2	1/8	5/8	$1.20
2	3/16	5/8	1.25
3	7/16	1	2.10
4	1/2	1¼	2.95

We have over 500 of both the 2 x ⅛ x ⅝ and 2 x 3/16 x ⅝ and offer discounts in quantity.

PLAIN MILLING CUTTERS

(without side chip clearance)

	Slightly used		
1¾	⅜	1	$1.00
1¾	½	¾	1.05
2½	2	1	3.00
4	¾	1	3.00

STAGGER TOOTH MILLING CUTTERS

Slightly Used

Dia.	Width	Arbor Hole	Price Ea.
4	1/2	1¼	$4.00
5¾	5/8	1¼	6.10

1½" dia. x 5/16" dia. x ⅞" arbor, high speed concave cutter.... **$1.75**

Left Hand Corner Cutter 2⅛" dia. x ⅞" arbor x ¼" radius..... **$1.05**

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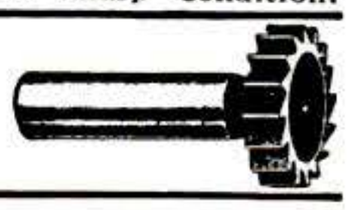

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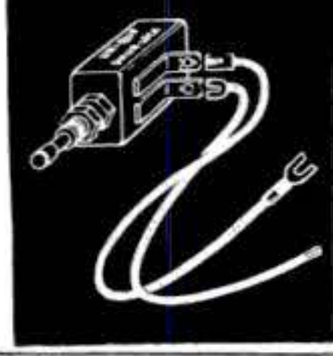

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POWER LAWN MOWER

with this DRIVE CUTTER ASSEMBLEE.

Constructed for those who desire to build their own mower or to replace your old cutter assemblee. Complete with 18" blade and double ball bearing drive. Add 50c to cover handling & shipping. No COD's. only **$11.95**

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DEALER INQUIRIES INVITED

10 HP AT 3400 RPMs! Thrill to 50 mph cruising—faster pickup than a car. **AUTOMATIC CLUTCH** with Powermatic Drive gives sensational performance No gears to shift!

Safe, smooth Brakes—50 miles per gallon — Length 71" — Height 41" — Weight 196 lbs.

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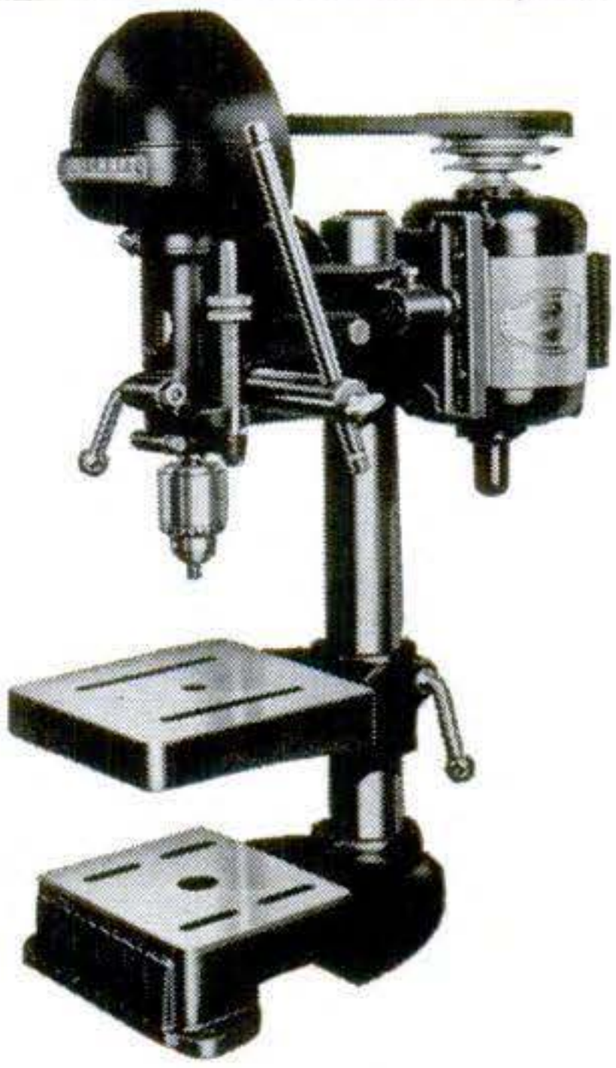

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Drill, mortise, rout, carve, sand, shape, grind — safely, accurately, inexpensively. Speed range, 700 r.p.m. to 4700 r.p.m. Sturdy quill has stop-rod, for repetition depth drilling. Many extra-value features. Complete accessories available. Ask your dealer to demonstrate this quality Delta Homecraft 11" Drill Press today.

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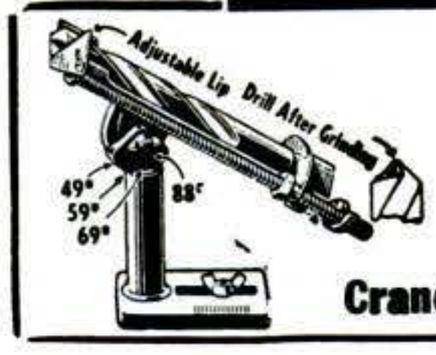

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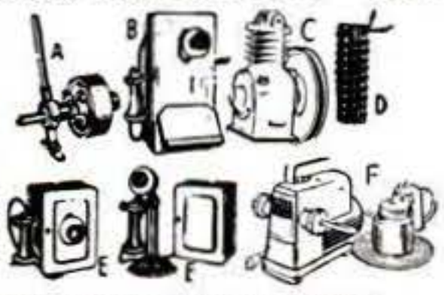

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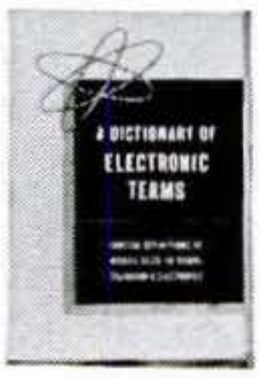

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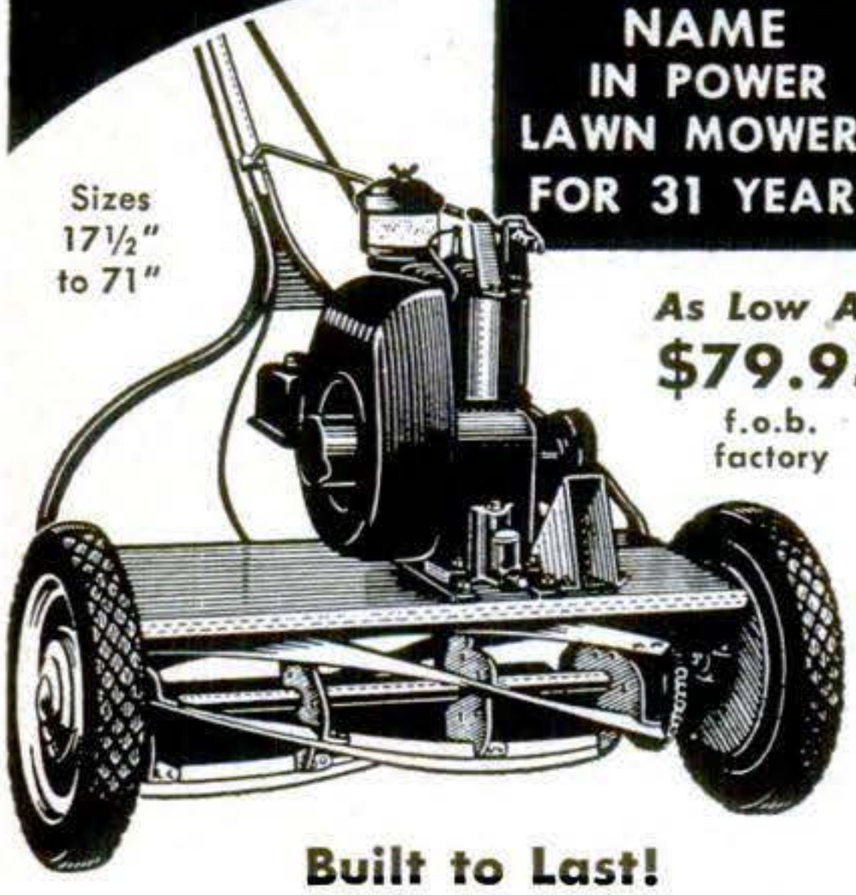

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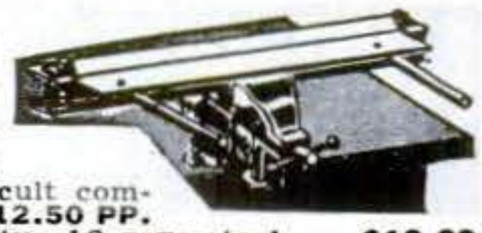

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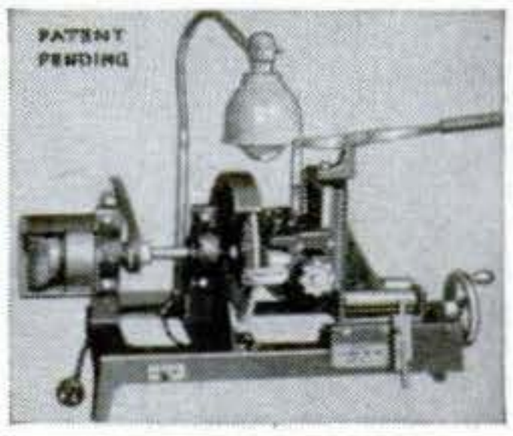

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Motor driven **$9.75** complete with vise

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FOR FARM AND HOME WORKSHOPS

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$29.95
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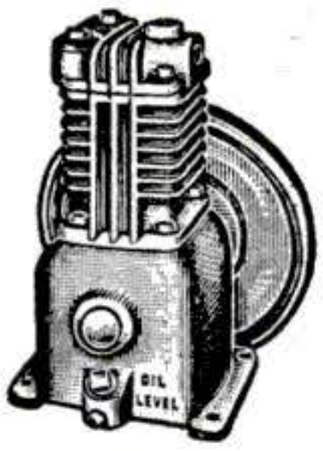
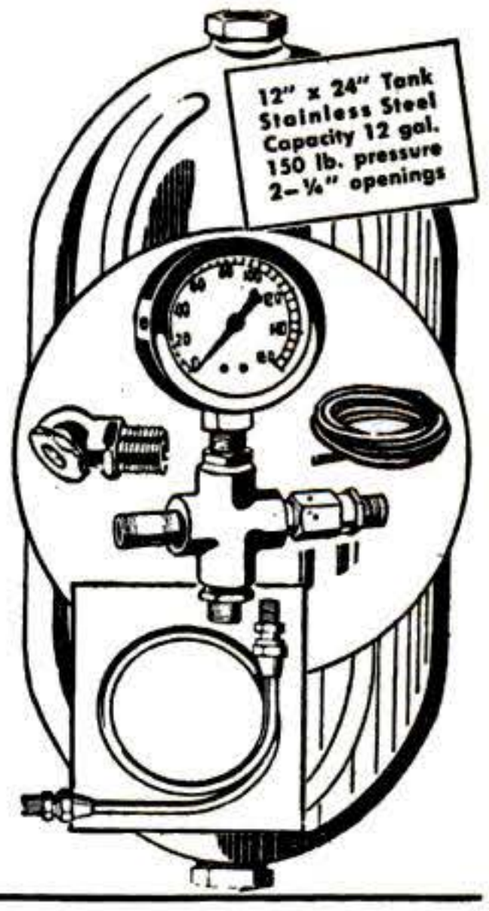


COMPRESSOR ONLY
Wt. 16 lbs.
$17.50

EQUIPMENT
less compressor
wt. 25 lbs.
$12.50



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Both valves in head, bronze bearings, splash lubrication, "V" belt drive, intake muffler and cleaner. Compressor has 2" bore, 1¾" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: ¼ h.p. at 100 lbs.; 1/3 h.p. at 125 lbs.; ½ h.p. at 150 lbs. or equivalent gas engine. *One Year Guarantee.* Replacement parts always available.

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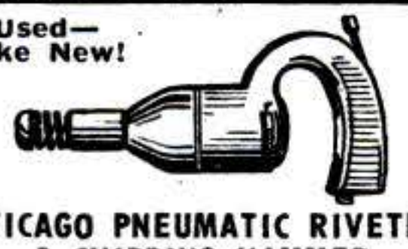

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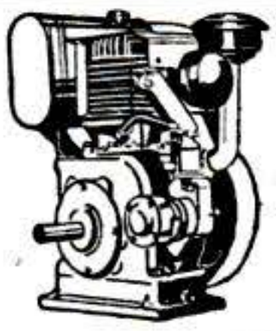

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Heavy Duty, ⅜" Core. Best piano wire. Ball bearing handle and arbor, rubber covered housing; for ½" motor shaft; for ½" bore wheels. Operates on ¼ H.P. Motor at 1725 or 3450 R.P.M. $29.00 Value. Wt. 8 lbs. **$14.20**

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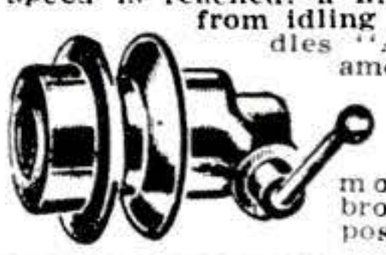
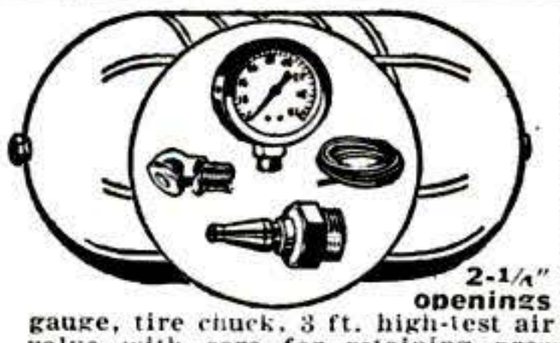
Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.25" pitch diameter. ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. **$7.50**





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2-¼" openings

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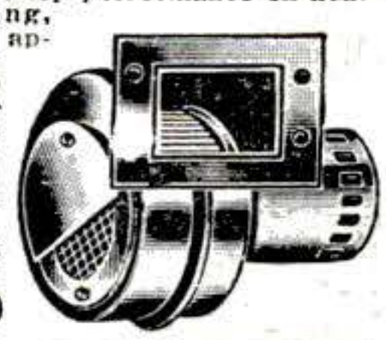
Single-inlet blower that gives top performance on heating, ventilating, exhausting, cooling, drying and similar applications. 5⅛" x 4" mounting flange with 2½" square discharge, 3½" dia. blower wheel powered by direct-connected 1/15 H.P., 110 V., 60C., A.C. motor with conduit box and 20" leads. 7½" wide less flange by 7¼" H. x 6¾" D. Suited for hundreds of new and replacement uses. Shpg. wt. 6 lbs... **$14.20**



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Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛" x 11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½". C.F.M., ¼" S.P. 1600; outlet vel. 1575; motor ¼ H.P. with overload relay; cord & plug, 110 v. 60 cy. AC. Ship. wt. 67 lbs. Special price..... **$39.50**

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A handy buyer's guide for home and factory workshop. Unusual bargains in motors, air compressors, electric tools, and many more items. Send 10c for postage and handling.

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• Right-angle drive with oversize guards is super-safe, perfectly balanced for one-hand use. Attach it to any drill ¼" and up, in seconds. Full 1⅛" cut, handles 2" stock by turning over. Machined cutting guide for extra accuracy. Oilite bearings, sealed gears for long life. Complete with 4" high speed steel saw blade. Money-back guarantee.....*only* **$7.95**

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5″ Electric SANDER-POLISHER
$29.95
(with sanding-polishing attachments)

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Home-Utility 5″ Sander-Polisher takes the hard work out of home jobs—saves you time and effort in hundreds of ways! With the attachments supplied, you can refinish wood; polish cars and silverware, wax furniture, woodwork and linoleum. A ¼″ Jacobs Chuck (only $3.45) and other low-cost accessories equip it for drilling in metal, wood, plastics; sharpening tools, cutlery, mower blades; removing rust and old paint; grinding, buffing and burnishing!

Easy for women to use, weighs only 3½ lbs. Extra-powerful universal motor runs on any standard light circuit, A.C. or D.C. Quality-built by BLACK & DECKER, world's largest maker of electric tools. See it, try it at your hardware, electrical or implement dealer! THE BLACK & DECKER MFG. Co., Dept. H5S, Towson 4, Md.

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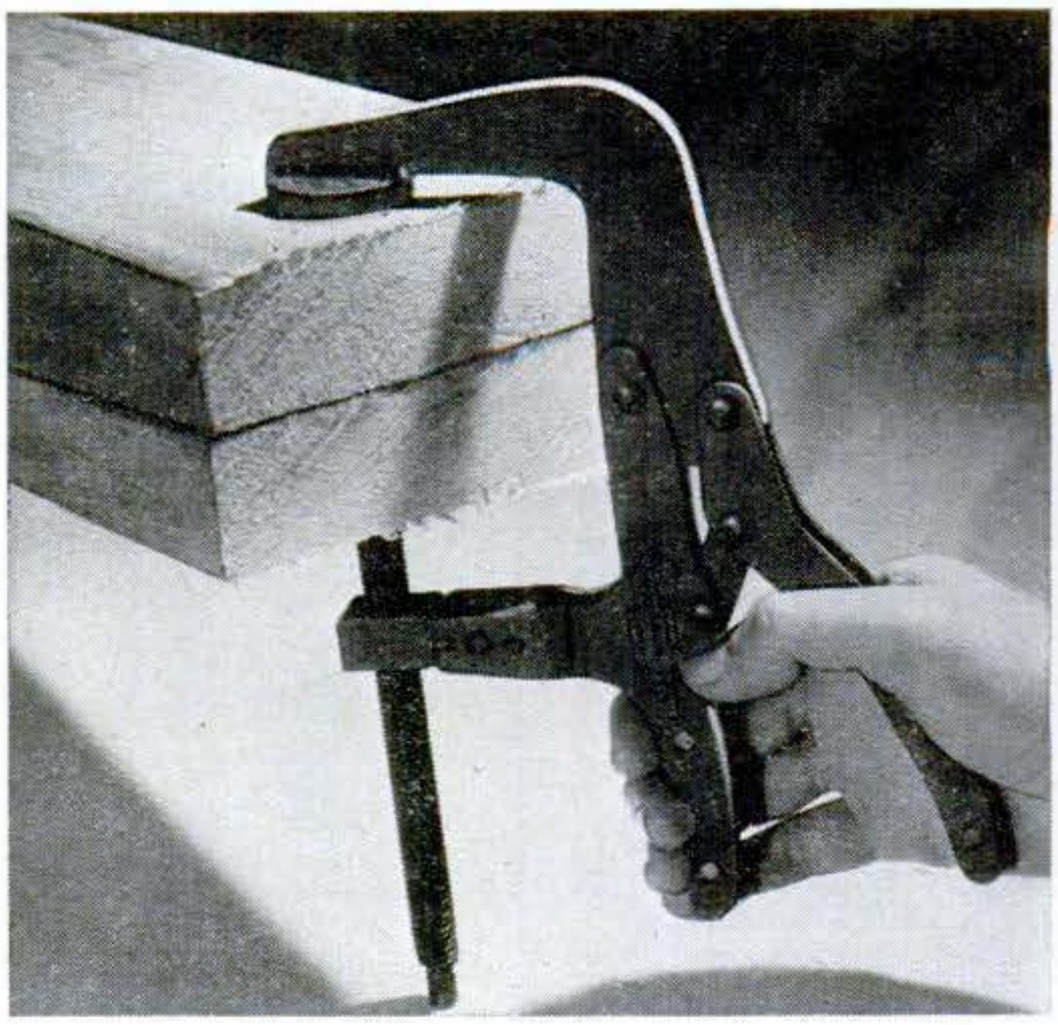
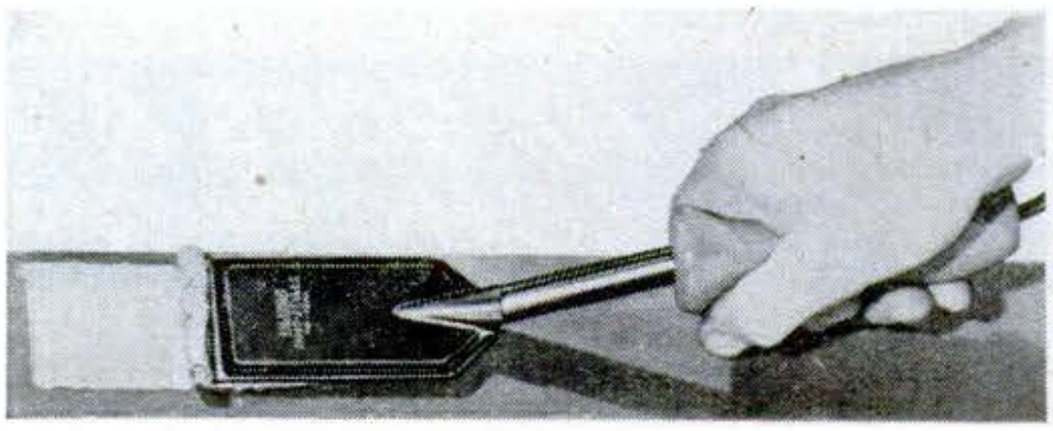
New



Toggle Action Locks C Clamp. These clamps, made by the Robert J. Kelly Mfg. Co., Waterford, Conn., can be quickly snapped on or off work. After the spindle is adjusted for the approximate thickness of the work, the clamp is slipped into place and the locking arm closed. The holding force is 600 lb. Prices range from $2.50 to $3.95, depending on the size of the clamp. The company also makes a welding clamp that has an undercut, removable spindle and a copper welding shroud.



Electric Paint Remover. Heat from a resistance element in the blade of this tool blisters and softens old paint so it may be peeled off as you push the tool back and forth. It operates on 115-volt AC or DC, weighs ¾ lb., has an 8′ cord, and is 12″ overall. The maker is Lectro Weld, Inc., of Cleveland, Ohio. The tool removes old paint down to the bare wood in one operation but will not scorch the surface of the work. Price is about $5.

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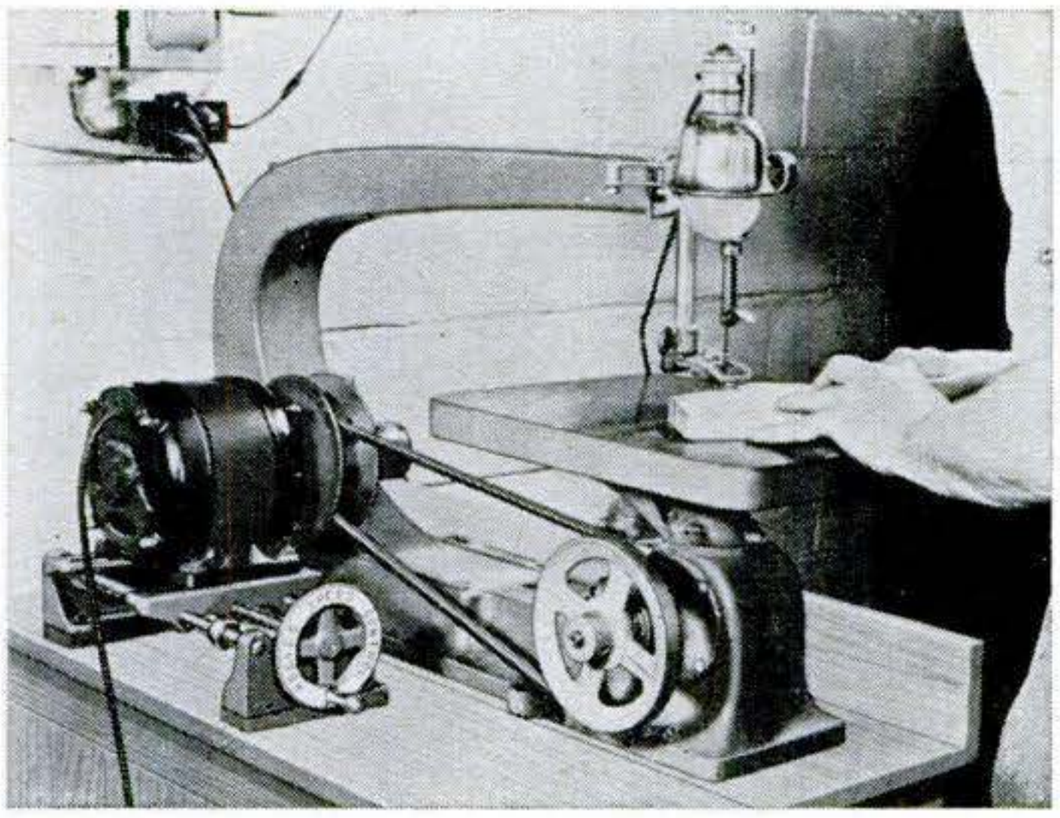
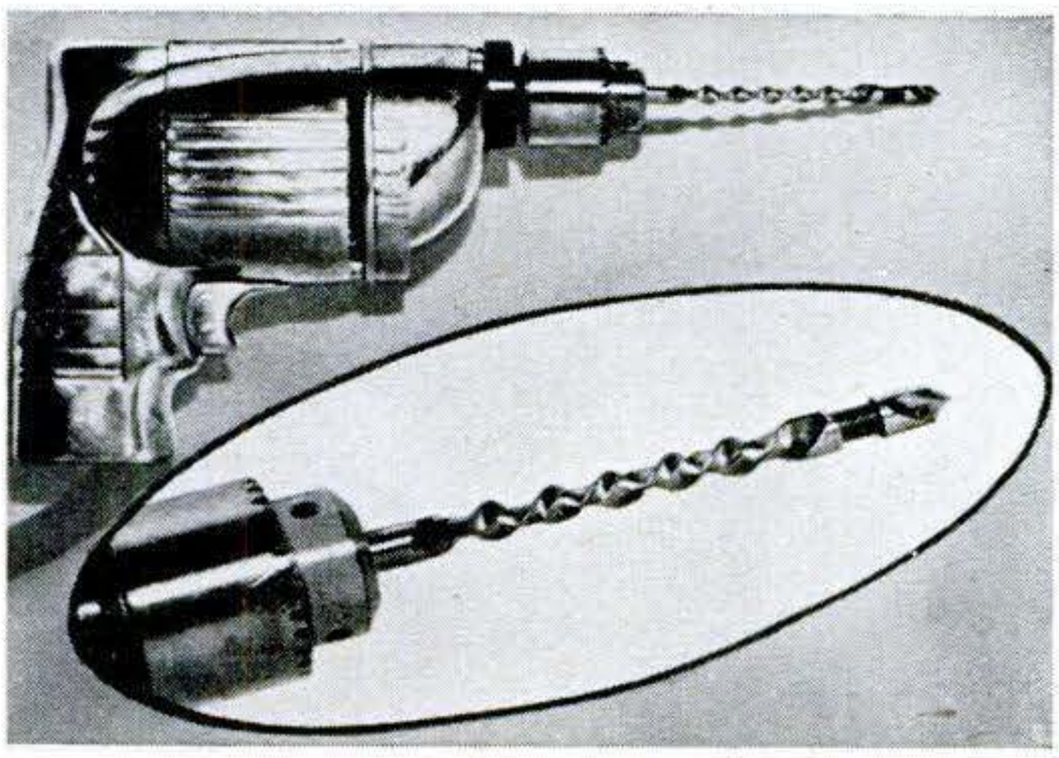
Tools



Variable Speed Changer. With the Vari-Speed Jr.® you can change speeds on workshop tools without stopping the machine. Turning the handwheel moves the motor forward or backward. This causes the belt to ride in or out on the two cone-faced disks on the motor shaft, changing the effective pulley diameter and therefore the speed. One disk moves laterally under spring tension as the belt rides in or out. Reeves Pulley Company, of Columbus, Ind., makes the unit to fit motors from ⅛ to 1½ hp.



Bit and Saw Combined. The end of the Cope-Saw® is used to drill through wood, plastic, or sheet metal. Then the inner part of the bit is pressed sideways against the hole, sawing along the stock in any direction. The International Twist Drill Corp., of Kansas City, Mo., sells the tool, which is made of high-speed steel. It fits any standard drill press or ¼″ electric drill.

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Ideal for nearly all finishes

Durable bristles... won't break off

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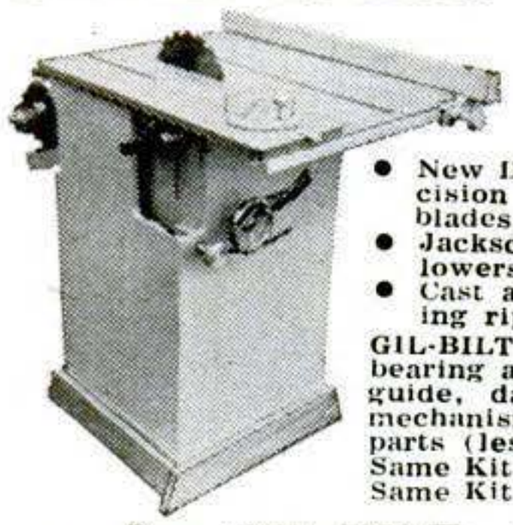
GIL-BILT 10-INCH TILTING ARBOR SAW



- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) $20.95
Same Kit with 10" Combination Blade . $24.90
Same Kit with 8" Combination Blade . . $23.90

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings.
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled.
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs.
- Uses standard 78 inch blades up to ⅜ inch wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts $16.95
Same Kit with two machined ready-to-install 12" cast aluminum wheels $20.95

Return Kits in 10 days for refund if not satisfied.
(Prices include postage within 600 miles. Over 600 add 5%)

Also available—Plans and Parts Kit for 8" Tilt/Table saw. Order Plans at $1.00 each—sent postpaid anywhere in the world or write for FREE descriptive catalog.

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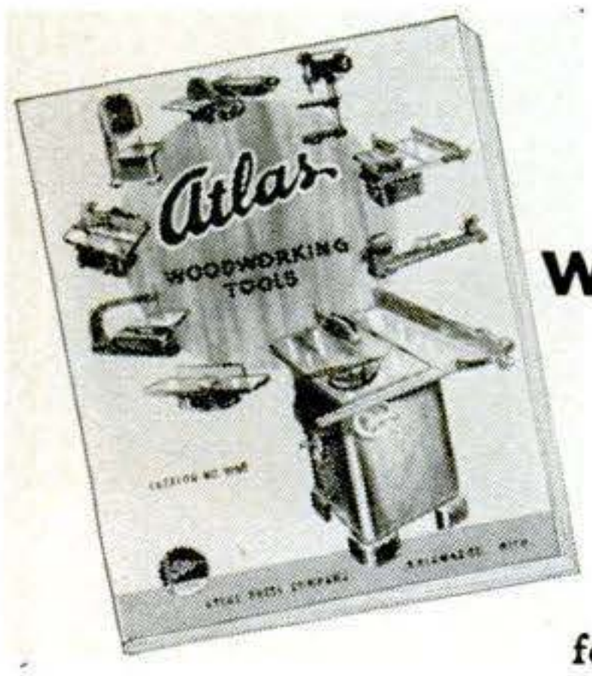

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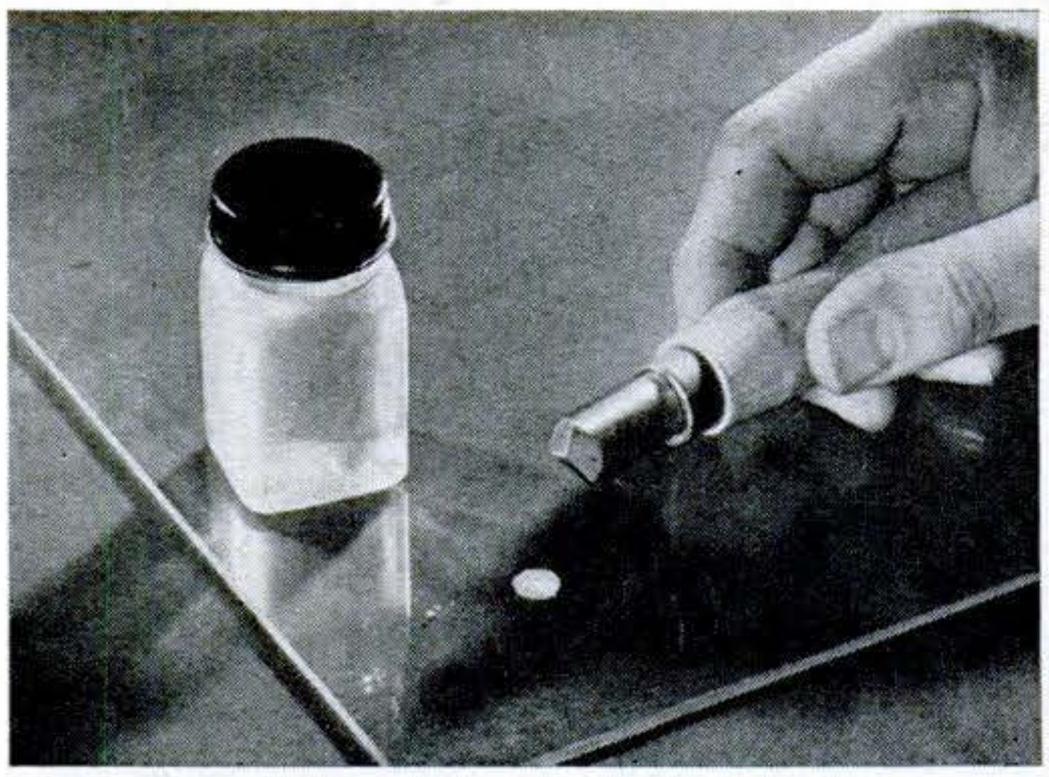
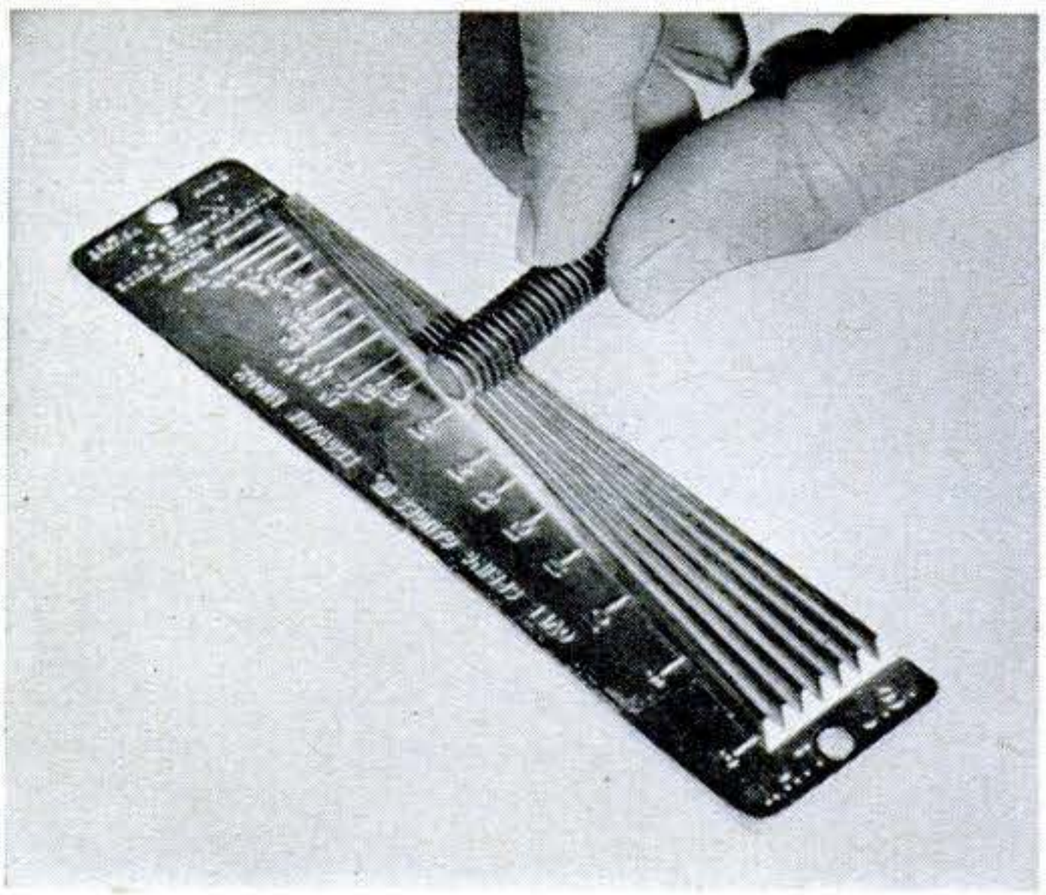
New Tools



Tool Drills Glass. This hand drill for glass, plus a bottle of cutting fluid, is sold for $1.90 by the Smith Engineering and Tool Co., of Glen Ridge, N. J. In use, the tool is held as you'd hold a screwdriver. You twist it back and forth, using light pressure and applying cutting fluid as needed. The tool also is available without the handle so it can be chucked in a drill. It comes in four sizes—⅛", ¼", ⅜", and ½". The tool also will drill tile. When used in a power tool, the slowest speed is recommended.



Screw-Pitch Gauge. Here's a simple gauge to measure the pitch of screw threads from 8 to 48 t.p.i. You press the screw on the grooves and move it along until the pitch of the grooves coincides with the pitch of the screw. The screw drops into engagement with the gauge grooves at that point, indicating the number of threads per inch. The tool is priced at $1.50 by the O-Vee Spring Gauge Co., of Los Angeles.

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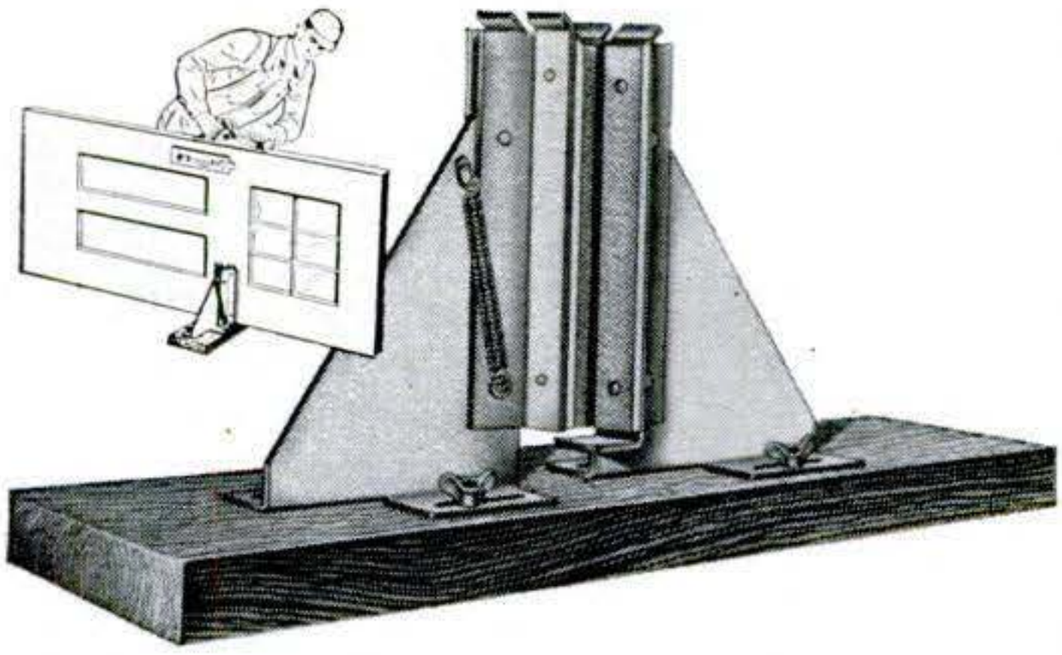
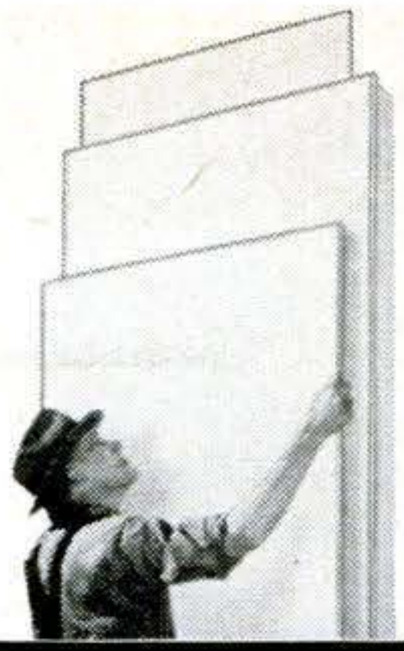
New Grinding Wheels. These wet grindstones have a constant rim speed even after the wheel wears down with use. A self-adjusting friction roller drives against the rim of the wheel, increasing its speed as the wheel wears, so that a rim speed of 280′ per minute is maintained. The Boice-Crane Company, Toledo, Ohio, is the maker. One model has two grindstones—one coarse and the other fine—driven by a single motor. The hand-operated model is for field use.



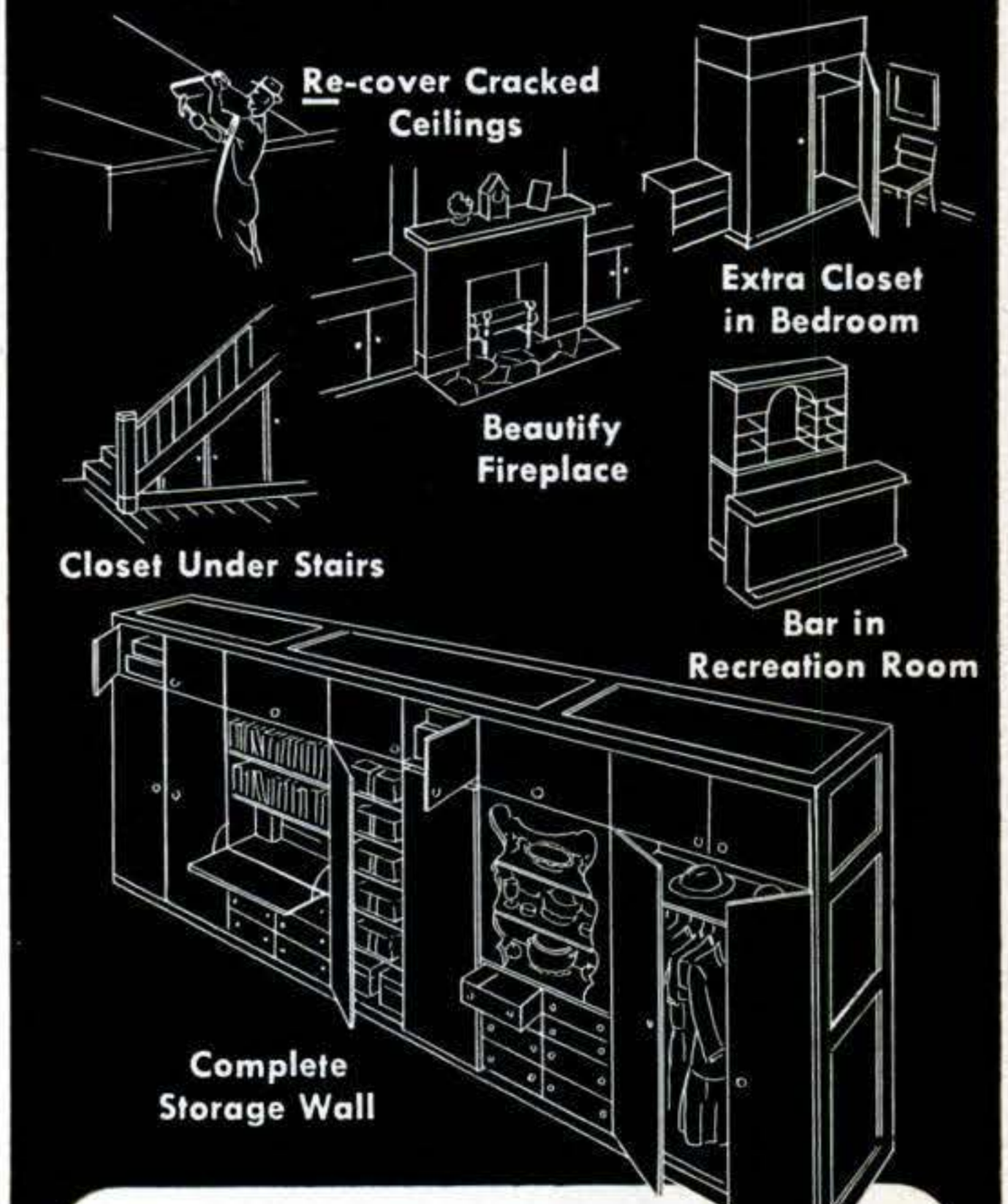
Clamp Holds Doors. Drop-Klamp® holds a door, window, sheet of plywood, or any flat object. The weight of the work wedges it firmly for planing, sawing, hinge and lock work, or fitting doorknobs. Fiber liners prevent marring of finished surfaces. The small board on which the clamp is mounted is not a part of the unit. The clamp is made of 12-gauge steel by the Lakeshore Mfg. Co., Minneapolis. About $5.



SAVE! BUILD IT *Better* WITH

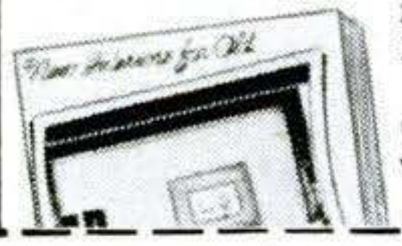
UPSON PANELS

WONDER BOARD OF 1000 USES!



Imagine—the things you can do with beautiful laminated pebble-surfaced Upson panels that saw like wood!

Won't crack, splinter or chip. Finest painting surface on any panel material. Apply with invisible Upson Fasteners to make large seamless surfaces —**without visible face nailing!** You get good insulating value too. Nearly every lumber dealer has Upson Panels in 4′ widths and a variety of lengths and thicknesses. The ⅜″ thickness is available in full wall sizes—8′ wide x 12′, 14′ and 16′ long.



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THE UPSON COMPANY

734 Upson Point, Lockport, New York

I enclose 10c for 32 page Idea Booklet. Include working drawings of Storage Wall.

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P.S. Last minute news & notes...

NEWBORN ELEMENT. University of California scientists, who only recently announced discovery of berkelium, element No. 97 (PS, March, '50, p. 298), have now discovered element No. 98. They propose to name it "californium," in honor of the university and state. Intensely radioactive, with a half life of only 45 minutes, californium is made from curium, element No. 96, by artificial transmutation in a cyclotron. Since all former gaps between Nos. 1 and 96 have been filled, this makes 98 chemical elements now known--a number that future discoveries may increase.

REFRIGERATOR DOORS: Westinghouse has a counting device now that automatically defrosts the machine after the door has been opened 60 times. And General Electric has put magnets in refrigerator door gaskets so that the doors will be drawn to the steel cabinets and held tight.

GAS TURBINES to drive propellers can be put on the double-deck Stratocruisers, Boeing engineers say. They are studying the necessary changes and believe they can have a turboprop Stratocruiser in the air in less than a year.

ARTIFICIAL RAIN isn't enough to satisfy Boston rainmaker Herman Cohen. When he seeds clouds for his customers--plantation owners in Cuba and South Africa--he uses a rainmaking liquid that contains phosphoric acid and other chemicals. Then the rain not only waters the soil, but enriches it with phosphate fertilizer and minerals. The final ingredient is a fluorescein dye: colored water in the rain gauges is visual proof that Cohen made it rain.

BETTER ANTIKNOCK gasoline is promised by chemists. They've identified compounds that have been interfering with antiknock agents, and are planning now to keep such stuff out of gasoline. . . . SOUNDS pitched too high to be heard by men may be used in the future in industrial plants to clean grease and grime off metal.

WANT A BELL to ring whenever someone turns into your driveway? The Nu-Way Signal Co., Chicago, is making a magnetic switch that can be set in dirt, gravel, or cement to sound an alarm when a car passes over it.

ASTRONOMERS at Harvard consider the sensational theory of Dr. Immanuel Velikovsky that the earth stood still a couple of times in Biblical days sheer nonsense.

ELECTRIC CLOCKWORKS for amateurs to install in walls, cabinets, or wherever they'd like a clock, are available now. Hart-Fargo Industries, St. Paul, Minn., is selling kits.

A MECHANICAL MECHANIC recently built by GE to work in atomic energy plants can't be shown in photos because of security considerations. It looks like a gun mounted on a railroad handcar, runs on a narrow-gauge track, and weighs about 5 tons. It has 6 small motors in its arm and hand, and 18 elsewhere, and can do almost anything a human arm and hand can do.

WHITE PAINT on the fuselage top to reflect heat may lower temperature inside an air liner. British Overseas Airways are testing the idea at tropical airports . . . DON'T BOTHER to wave if you see a yellow-winged plane with a large figure painted on its yellow tail. That's the way the Air Force is marking its remotely controlled drones . . . THE PILOT was to blame in 758 of 850 fatal accidents in private flying recently reviewed by CAB.

The Editors

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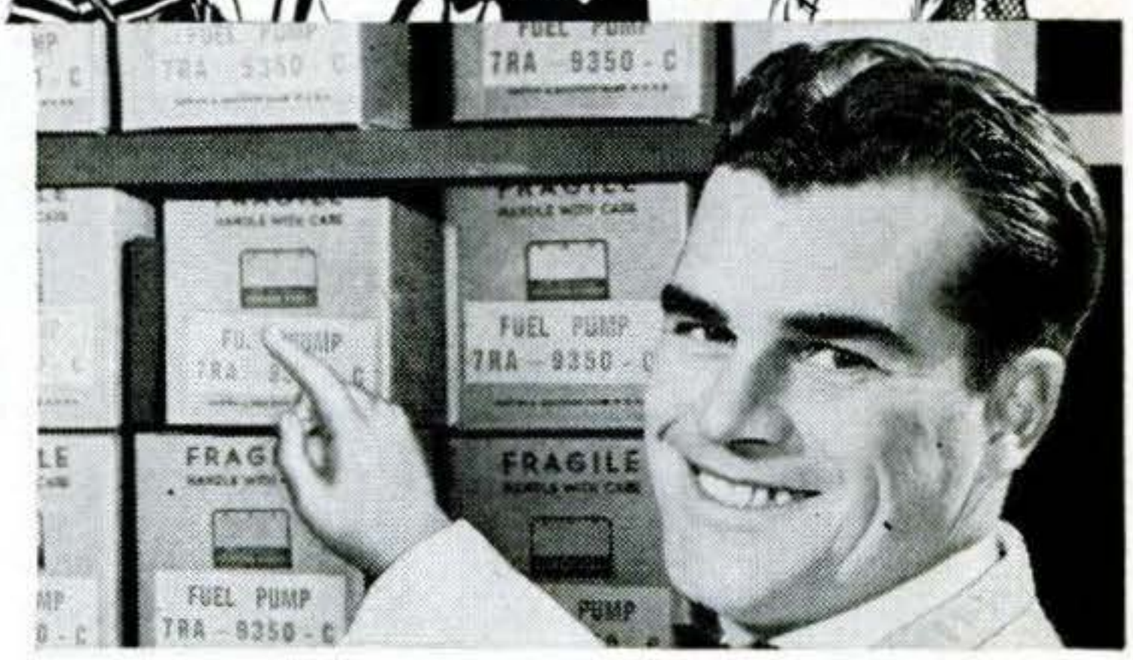
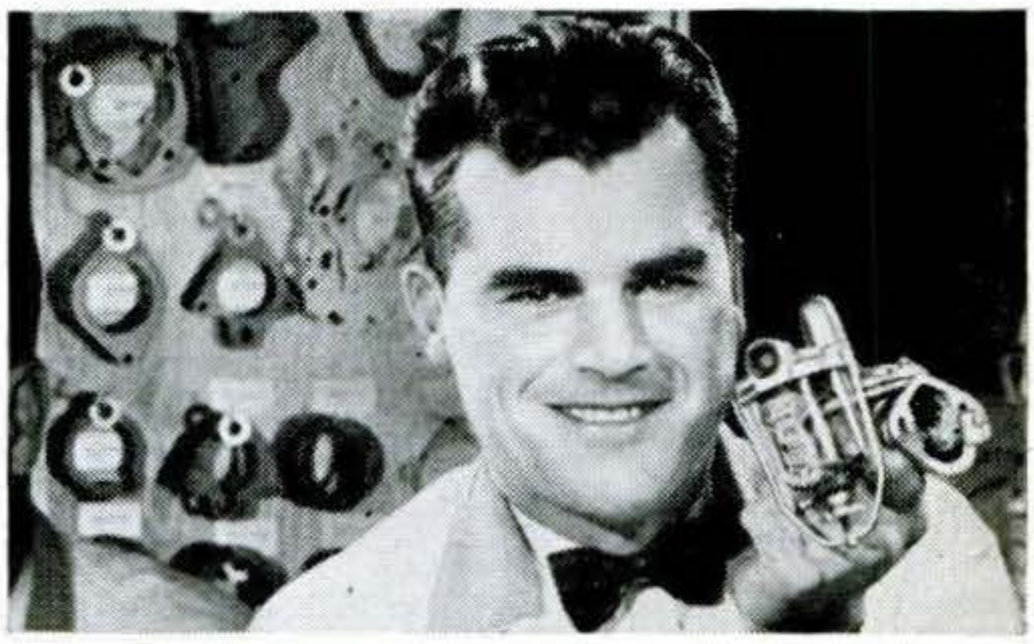
"Mister, You're a Genius!"

"A MATTER OF MINUTES AND YOU'VE GOT HER RUNNING LIKE NEW!" I TOLD THE MECHANIC.



"THAT'S EASY," HE REPLIED. "WHEN YOU'VE GOT THE RIGHT PARTS, THERE'S NOTHING TO IT."

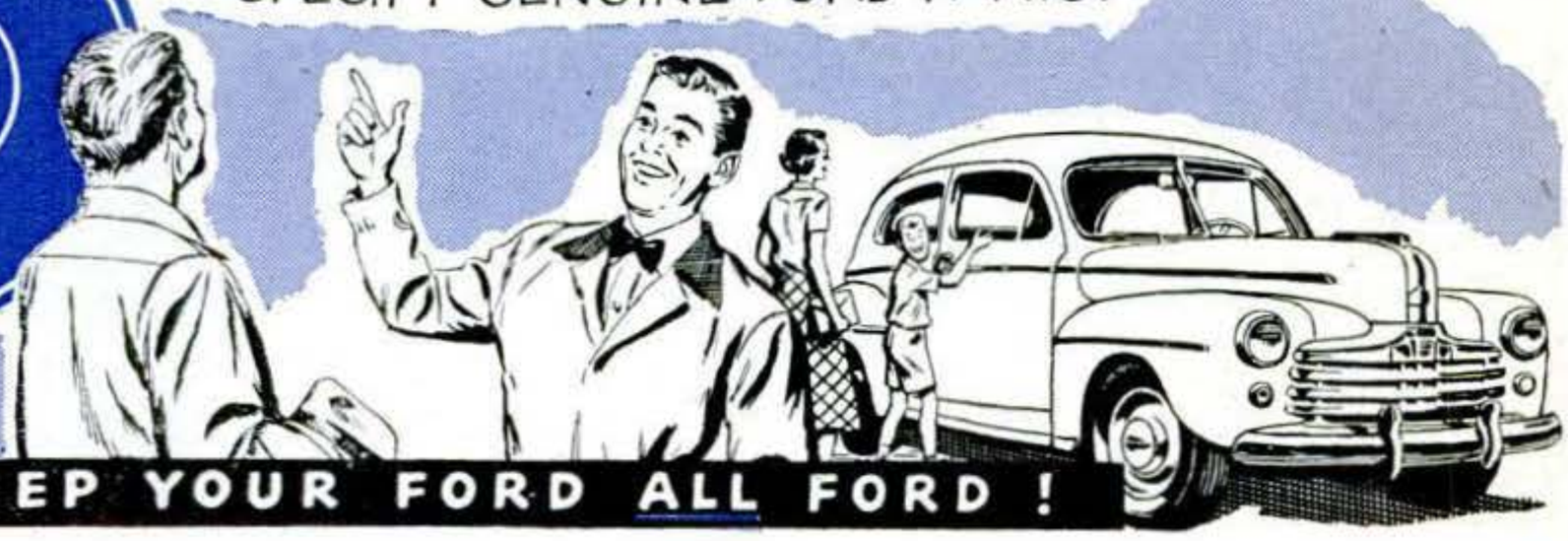
"RIGHT PARTS?" SAID I. "YES, GENUINE FORD PARTS," HE CONTINUED. "THEY'RE MADE RIGHT TO FIT RIGHT TO LAST LONGER."



"AND, BECAUSE THEY'RE DESIGNED BY THE MEN WHO DESIGNED YOUR FORD, THEY SAVE YOU TIME AND MONEY."

GENUINE Ford PARTS

"THAT'S WHY YOU'RE SMART TO LOOK FOR THIS SIGN (AT FORD DEALERS AND SELECTED INDEPENDENT GARAGES). AND ALWAYS SPECIFY GENUINE FORD PARTS."



KEEP YOUR FORD ALL FORD!

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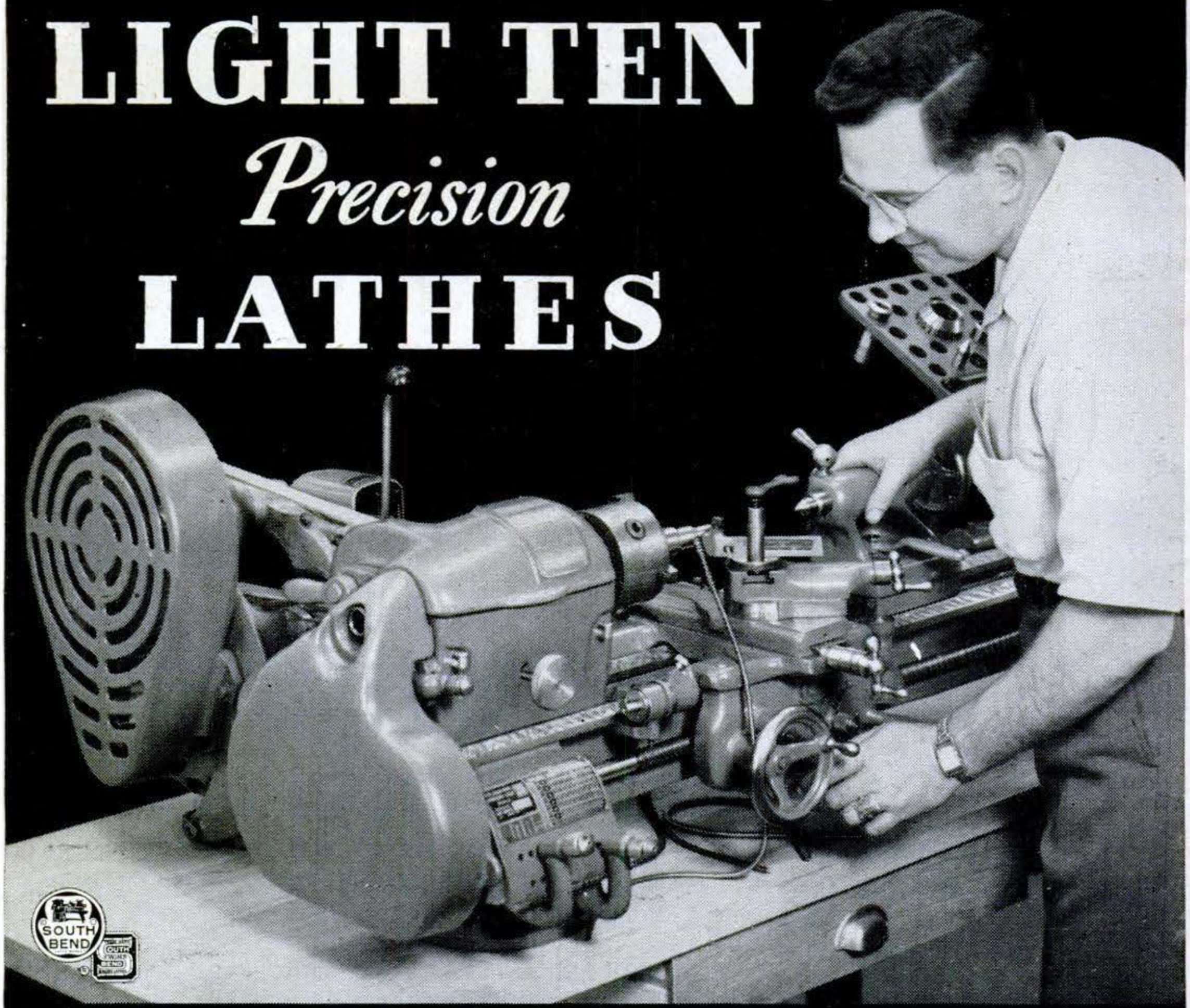
New- SOUTH BEND LIGHT TEN *Precision* LATHES

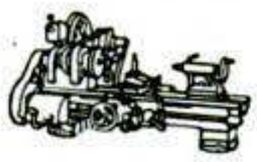
A completely new, moderately priced, 10″ swing lathe designed for the efficient machining of small, precision parts. Available in four models, and four bed lengths. Send for information at once — *use coupon below.*



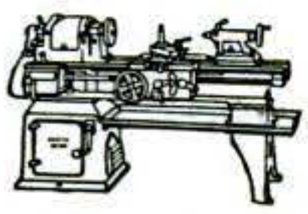
Building Better Tools Since 1906 • SOUTH BEND LATHE • South Bend 22, Ind.

Send Information Checked:

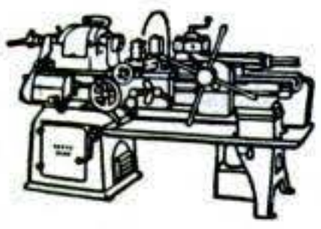
- ☐ LIGHT TEN LATHES
- ☐ LATHE ATTACHMENTS
- ☐ TIME PAYMENT PLAN



☐ 9″ and 10″ BENCH LATHES

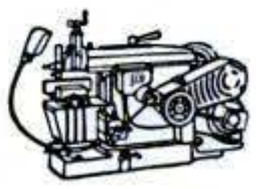


☐ 10″ to 16-24″ FLOOR LATHES



☐ 1/2″ and 1″ Collet TURRET LATHES

☐ 14″ DRILL PRESSES



☐ 7″ BENCH SHAPERS

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NEW
TOMOTIVE
DISCOVERY

DO YOU WANT TO SAVE GAS

(Patent Pending)

THE AMAZING GANE *Air Flow* NEEDLE

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direct to mo- ts on a FREE L basis ONLY. exclusives are ilable for any ufacturers or ers of automo- parts.

MECHANICS AND SCIENCE RESEARCH CO.
EAL OF APPROVAL

EASY TO INSTALL—TAKES ONLY A FEW MINUTES—Just remove the solid idling adjustment screw in your carburetor and screw in the SENSATIONAL GANE "AIR-FLOW" NEEDLE. (6 cylinder cars take 1; 8 cylinder cars take 2.) **THE OBJECT:** Unlike the solid idling adjustment screw in your carburetor, there is a hole down the center of the GANE "AIR-FLOW" Needle (patent pending). Thru this channel, air (cleaned and filtered by the cap) is sucked into your carburetor, lessening the vacuum in the idling chamber at the point of gasoline delivery into the mixing chamber—thus attempts to give your car a smoother, slower idle—LESSENING LOADING and **WASTE OF GASOLINE.**

about ½ MILLION now in use!

You've read about them in many NATIONAL MAGAZINES—everybody is talking about them. NOW, YOU can try the Sensational "Air-Flow" Needle in your car **AT OUR EXPENSE**—you don't risk a penny. Most users who write swear by them and report.

AMAZING GAS MILEAGE

—many comment on EASIER STARTING, FASTER PICKUP, SMOOTH MOTOR and BETTER IDLING. (Hundreds of such letters have been received so far). But FRANKLY, some users report "NO improvement," and fire them back—proving they SOMETIMES don't work for some reason. THEREFORE, we invite YOU to try the "Little Stinkers" WITHOUT COST—we want you to TRY BEFORE YOU BUY.

TRY THEM FREE FOR 10 DAYS

and check for BETTER ENGINE PERFORMANCE and gas mileage which should average **2 OR MORE EXTRA MILES PER GALLON** or needles are NOT worth buying. IF SATISFIED send only $1.50 per needle. IF NOT SATISFIED—just return them and YOU'LL OWE NOTHING and WE'LL ASK NO QUESTIONS. FAIR ENOUGH?

WHAT MANY "WHO SHOULD KNOW" HAVE TO SAY ABOUT THIS NEW AUTOMOTIVE DISCOVERY

CARBURETOR ENGINEERING CO—"Tests used 3.6 gallons LESS with Gane Air-Flow Needles . . . a saving of 72c in ONE DAY." Otto H. Dahlke, Ferguson Carburetor Engineering Co. **YELLOW CAB CO.**—"Mileage check on 4 cabs showed 10.1 mi. per gallon without—12.5 mi. per gallon with Air-Flow Needles—Supply our entire fleet at earliest convenience," Yellow Cab Co., Evansville 2, Ind. **TRUCK OWNER**—"The saving after Needle was installed, averaged $1.00 per day." Joe D., Bellaire, Ohio. **POLICE**—I'm equipping all the patrol cars of our police department, please rush order." **NEWSPAPER**—"The Gane Air-Flow Needle gives you from 2 to 4 extra miles a gallon." Tony Weitzel, Detroit Free Press.

LOOK WHAT OME USERS REPORT

hese letters are typical of the hundreds of letters we have already received.)

UP TO 25% MORE MILEAGE

re miles per gallon of gas,
writes G.H.W., Bronx, N. Y.

nore miles per gallon of gas,
writes N.D., Homeworth, Ohio

nore miles per gallon of gas,
writes M.L., Ashton, Idaho

5 more miles per gallon of gas,
writes M.B., Midwest, Okla.

Air-Flow Needles are a wonderful invention. increased my mileage from 14 miles per gallon miles per gallon." D.O.C., Stillwater, Minn.

ASIER STARTING

es a grand difference in my Buick in starting, and mileage." M.D., Kimrall, Nebraska.

car starts much easier now—thanks."
V.C., Ojai, Calif.

ASTER PICKUP

ced the difference in idling and pickup as soon started the car after installing them."
T.W., St. George, S. C.

MOOTHER ENGINE PERFORMANCE

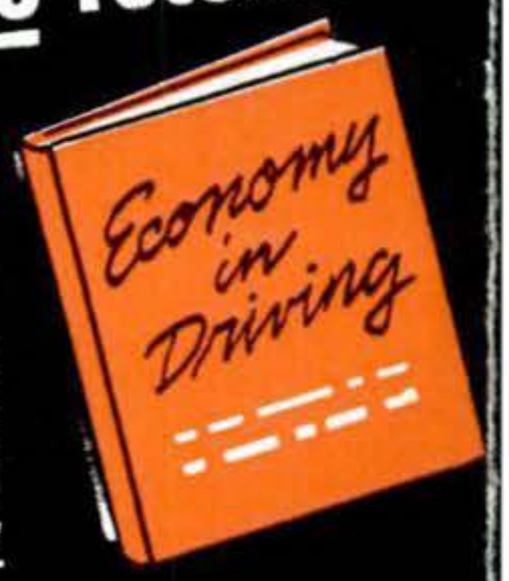
dle, O.K. Difference in engine performance is many times the needle cost."
G.A., Olathe, Kans.

old Nash runs smoother and starts better."
L. P., Salt Lake City, Utah.

ration of my car has been vastly improved."
R.F, Springfield, Mass.

MAIL TODAY and you will also receive

FREE BOOK "Economy in Driving"



(American Motorists Demanded That This Book Be Written)
Tells you MANY ways to SAVE GASOLINE, OIL, TIRES, AND CUT YOUR AUTOMOBILE OPERATING COSTS. Written so you can understand and follow its simple instructions. Also tells about the many other gas saving and economy products sold by National Automotive Research Corporation. It's yours TO KEEP, ABSOLUTELY FREE, when you send for your FREE TRIAL Gane "Air-Flow" Needles.

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"Camels agree with my throat"

say these famous **20-GAME WINNERS OF BASEBALL**

MEL PARNELL

BOSTON RED SOX (WON 25)

Top winner in the major leagues last season, left-hander Mel Parnell made the Camel 30-day mildness test, and reports: "Camels agree with my throat. They're a mild, great-tasting smoke. Camels for me!"

HOWARD POLLET

ST. LOUIS CARDINALS (WON 20)

"The throat specialists' findings in the 30-day test don't surprise me," says this veteran southpaw. "I've smoked Camels for many years. I *know* they're mild—they're always right for my throat. And Camels have the flavor I like."

VIC RASCHI

NEW YORK YANKEES (WON 21)

The "Big Wheel" of the World Champions, Vic Raschi, smokes Camels—because, "Camel mildness agrees with my throat. There's nothing so cheering as a Camel—that flavor hits the spot!"

BOB LEMON

CLEVELAND INDIANS (WON 22)

"The 30-day test really opened my eyes," says Bob, only major league hurler to win 20 or more games in each of the past two seasons. "Camel mildness is welcome to my throat."

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

NOTED THROAT SPECIALISTS REPORT ON 30-DAY TEST OF CAMEL SMOKERS . . .

Not one single case of throat irritation due to smoking CAMELS

Yes, these were the findings of noted throat specialists after a total of 2,470 weekly examinations of the throats of hundreds of men and women who smoked Camels—and only Camels—for 30 consecutive days.

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